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REMOVAL NOTICE.

The business of THE ELECTRICAL WORLD continues to grow, and therefore to require more and more space for its transaction. On May 1 the paper will remove its offices to a more pleasant and extensive home than any it has yet occupied. This will be in the recently completed—and, for the headquarters of the oldest electrical journal in America, appropriately named—"Franklin" Building, Nos. 9, 11, 13 and 15 Murray street, 150 feet from Broadway, and next to the building in which its present offices are located. Thus THE ELECTRICAL WORLD in its twenty-fifth year takes up its quarters in a new and modern skyscraper, erected on the site of its first office of a quarter of a century ago, and bearing a good old pioneer electrical name. The paper has never, by the way, occupied an office further from No. 9 Murray street than across City Hall Park. This removal to the adjoining building will not of course change the number of the telephone call—924 Cortlandt—or of the Post Office box—789—or the cable address—"Electrical," New York. Although the building covers four lots and has four numbers, THE ELECTRICAL WORLD will, for the sake of old times, use but one—its original, No. 9 Murray street. From the extra space the paper will have in its new quarters it has been able to spare a room for the use of its friends when they visit the metropolis. We shall be glad to have more of these address their mail care of THE ELECTRICAL WORLD, and there will always be a stenographer to whom they will be entirely welcome to dictate letters. Any information we can give them will, of course, be at their disposal, as it always has. The more avail themselves of the facilities provided the better we shall like it.

VOL. XXXI. NEW YORK, APRIL 30, 1898. No. 18.

CONTENTS.

Editorials ... 517
The Plant of the Ellicott Square Building, by F. L. Wilson ... 519
Some Ingenious Applications of Electricity in Warfare ... 522
The Calculation of Transformer Efficiencies ... 523
Oscillatory Currents and Some of Their Phenomena—I., by Prof. E. F. Northrup ... 524
The Ballston Terminal Railway ... 526
The Reconstruction of the Power House of the Union Traction Company of Philadelphia ... 527
Additions to the Equipment of the Massachusetts Institute of Technology ... 528
War Notes ... 528
Hertz Wave Signalling in War, by Charles T. Child ... 529
The Power Plant of the Trans-Mississippi and International Exposition ... 529
Lowering Transformers for Niagara Power, by Ludwig Gutmann ... 530
Some Early Electric Railways, by J. C. Henry ... 530
Digest of Current Electrical Literature, compiled by Carl Hering ... 531
Book Review ... 534
Electric Power in the San Rafael Paper Mills, Mexico ... 535
Lightning and Sneak Current Arrester ... 535
The Hartford Section Insulator ... 535
Thermostatic Electric Cables ... 535
Dealers in Second-Hand Apparatus Enlarging Their Facilities ... 535
Battery Fan Motors ... 535
Electrical Exposition Notes ... 536
An Improved Double Valve Automatic Engine ... 536
Departments:
- Financial Intelligence ... 537
- Special Correspondence ... 537
- General News ... 540
- Personal Notes ... 542
- Trade and Industrial Notes ... 543
- Business Notices ... 543
- Illustrated Record of Electrical Patents ... 543

THE EFFECT OF WAR ON THE ELECTRICAL INDUSTRIES.

Owing to the fact that the electrical industries have developed from nothing since the last great war in Christendom it is impossible to tell from precedent what the effect upon them of a serious war would be. The preparations for war and the final declaration have shown two quite opposite effects, which to a certain extent neutralize each other. All large proposed electrical undertakings and installations have been promptly laid on the shelf, owing to the timidity of capital under such a condition. This has caused many large orders to be cancelled and many other expected orders to be indefinitely put off. On the other hand, the Government's needs in the way of electrical equipments for signaling purposes, for the lighting of its vessels and fortifications and to a limited extent for the transmission of power, have caused many rush orders to be given for apparatus, the effect of which, especially in the cases of concerns making a specialty of the particular apparatus wanted, has been a great stimulus. This, however, will undoubtedly not last long, the apparatus being more in the nature of permanent installations than supplies, so that once the preparations are completed the electrical industry will probably fall somewhat below its normal activity.

The applications of electricity, even in this youthful period of their life, have come to be necessities rather than luxuries. People will still need electric light, use the telegraph and telephone, and continue to ride in electric cars, so that the industry will not be depressed as much as would one supplying less necessary products. Investors of capital are ultra-sensitive, and unless the war is a long and serious one, which we all hope and trust it may not be, the advance of the electrical arts in this country will go on with but slight disturbance.

SMALL DYNAMOS AT LOW SPEEDS.

Few but the actual designers realize the difficulties of designing a motor or generator of small power to run at low speeds, with a reasonable efficiency and a non-prohibitive first cost. In any machine the reduction of the peripheral speed at the air gap causes practically a proportional reduction of the output. In direct-current machinery, therefore, the simplest solution of the problem is to take a machine of greater power at normal speeds and by reducing the one simultaneously bring down the other—a suitable winding being chosen—until the desired result is attained. This naturally does not reduce the cost of construction, and therefore renders the cost per kw output inversely proportional to the speed and also affects the efficiency in a somewhat similar manner.

In the case of alternating current machines the problem is a little different, as at commercial frequencies it is not advisable for several reasons to reduce the length of the polar arc much below that of standard practice. The frequency being fixed, a given reduction of the angular speed of the machine necessitates a proportional increase of the diameter, and the consequent increase of the capacity can only be economically offset by reducing the axial length of the active winding. This process results in the production of the fly-wheel type of alternator for direct connection to low-speed engines or turbines. In some of these machines of recent construction the revolving part has a diameter of 8, 10 or 12 feet, with active conductors but 12 or even 8 inches in length. To

build a machine of this type to run at the same speed, frequency, density, etc., and of one-half the capacity of a given machine, requires practically the same shaft and revolving spider, and but slightly reduced field magnet structure, practically the same casting for the external stationary structure, just one-half as much laminated iron in the induced portion, the same end plates, hardly any reduction in the amount of copper and insulation, owing to the proportion the end connections bear to the total length of winding, and almost the same amount of work. The result is that the cost is reduced perhaps by 10 or 15 per cent. and that at a considerably reduced efficiency.

THE USE OF MOTORS IN THE CONSTRUCTION OF BUILDINGS.

The recent complaints of the proprietors of a prominent hotel in Chicago and their attempt to legally restrict the work of the contractors on a neighboring building on account of the nuisance to the guests suggests the great advantages of electric power over steam for such work. In the construction of modern steel buildings quite a variety of power-requiring machinery is used. Pile drivers, pumps, air compressors (if caissons are used), hoists, derricks and elevators are driven from clumsy, noisy little steam boilers and engines, which are shifted from place to place as the work proceeds.

The substitution of motors for these steam boilers and engines would render the machines much lighter and hence much more readily moved about; would reduce the attendance and the cost of fuel, and increase the ease of handling the work, beside the incidental advantage in cases like that in Chicago of greatly reducing the nuisances of noise, steam and smoke in the neighborhood.

Such work can best be supplied from central station service, as the load is only a temporary one in any one locality. As large contracting firms possess their own steam hoists, pumps, etc., which they move from work to work, and would not be inclined to purchase motor-driven machines which would only be of use in certain localities, it might be well for central stations desirous of obtaining such a load to equip complete hoists, pumps and the other devices most frequently used and rent them out for such work. The advantages enumerated above would promptly cause a considerable extension of the substitution of power for handwork in this line once the electric equipment were inaugurated.

A QUESTION OF TERMS.

The newspapers have saddled the new open conduit electric railways with the name "underground trolley" roads. This barbarous misnomer has even found acceptance in a recently published programme of an electrical society meeting.

The variations of meaning which the word "trolley" has undergone since the electric railway marked it for its own are remarkable. Originally a trolley was a tilting railway truck, or dump car, and later a truck from which a load was suspended. In early electric railway practice in this country the term came to be applied to a little carriage that ran along on top of the conducting wires, and which was towed behind the car by a flexible cable. When the under-running wheel pressed against the conductor by a pole was invented the word was transferred and commonly accepted, giving, in time, by a popular metathesis, a convenient name for the whole system of which the wheel and pole were the most conspicuous outward and visible signs. It is therefore natural that with the coming of the conduit electric railway the distinguishing word "trolley" should be associated in the minds of laymen with electrically propelled cars, and since the conductors are underground that the term "underground trolley" should be coined. The only difficulty about its use is that there is no longer even a semblance of a trolley used in this system.

Just what to suggest as a short and accurate designation for this kind of railway system is rather a difficult question. "Conduit railway" applies equally well to cable roads, but as these latter are doomed to an early extinction it is perhaps as good as any other name. Certainly the term "trolley" should not be used in the description of a system in which it has no part, and of which the success means the ultimate disappearance of the overhead pole and wheel.

THE DIFFICULTIES OF THE RANGE FINDER.

The range finder, and particularly the modified form of that instrument, whereby the range is indicated directly by electrical means, has been talked about so much of late that it must have met with some measure of success. This is quite remarkable, if the difficulties of the problem are considered, and if true indicates no little skill in the construction of delicate instruments. For use on shore with long base lines between the points of observation the range finder or position finder, as it might better be called in this application, is capable of all the accuracy obtainable in surveying by triangulation. But on shipboard, with an extremely limited base line, often sharply oblique to the direction of the target and with the constant turning, rolling, pitching and even more violent motions of a ship in action, the problem is a different one.

For the estimation of distances up to a few thousand yards the gunner's judgment is sufficiently accurate, as the trajectory of the projectile of a modern high-power gun is practically straight for that distance, and a considerable and accurately determined elevation is only necessary when the range runs up into distances measurable in miles. The distance is, of course, determined by the deviation from parallelism of the lines of sight toward a distance object from two points on the ship. These two points may be 200 feet apart. In this case the two rays of light coming from an object 5 miles away are naturally very closely parallel. Assuming the graduated circles on which the angular difference is measured to be 2 feet in diameter, the arc to be measured would be about 1-10th of an inch in length and an error of 1-100th of an inch would make a difference in the range found of about one-half a mile. In case the target is not directly abeam the conditions become still worse. When used on a ship plunging in a sea way the range finder telescopes must be constantly in motion, and slight instantaneous deviations of either one from the true direction of the target would give the indicator needle oscillations worse than those of the ammeter of a two-car railroad power house. If, in spite of these difficulties, the instrument is commercially operative on shipboard, it certainly speaks well for the designers and constructors of the apparatus.

League of American Municipalities.

The second annual convention of the League of American Municipalities will be held in Detroit, Mich., on August 1, 2, 3 and 4, next. Topics suggested for the programme include the following: "Electric Lines, Overhead and Underground"; "What Means Could a Municipality Use to Protect Life and Property from the Improper Construction of Electric Lines for Telephone, Telegraph, Lighting and Street Railway Purposes"; "Remuneration to Cities for Franchise Rights in, Over and Under Public Streets and Alleys—What Remuneration, if Any, Should Be Exacted From Light, Water, Street Railway, Telephone and Subway Corporations, and How Should It Be Collected," and "Municipal Ownership of Public Service Industries—What Progress Has Been Made in This Line in the United States and Canada and With What Results?—What Should Be Its Limitations?"

The Plant of the Ellicott Square Building.

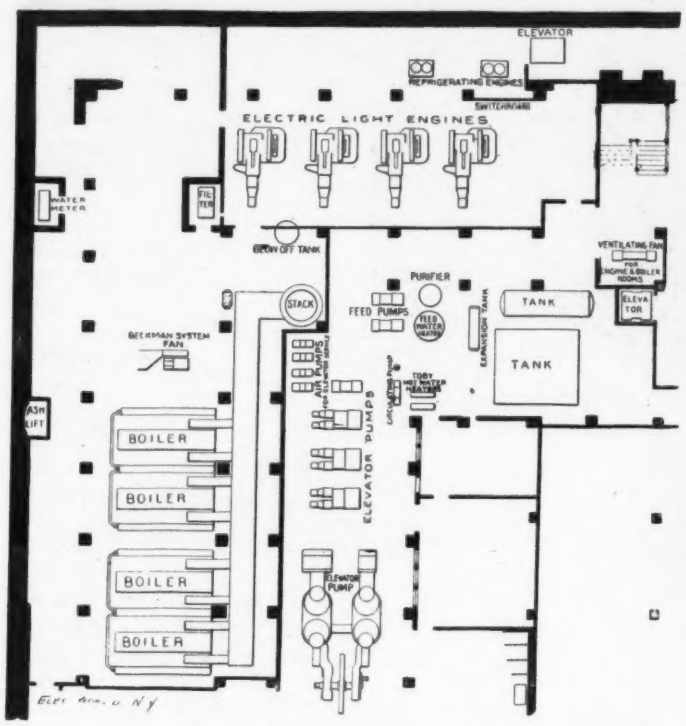
BY F. L. WILSON.

IF a stranger were asked what impressed him most forcibly on visiting Buffalo it is not unlikely he would say the Ellicott Square Building.

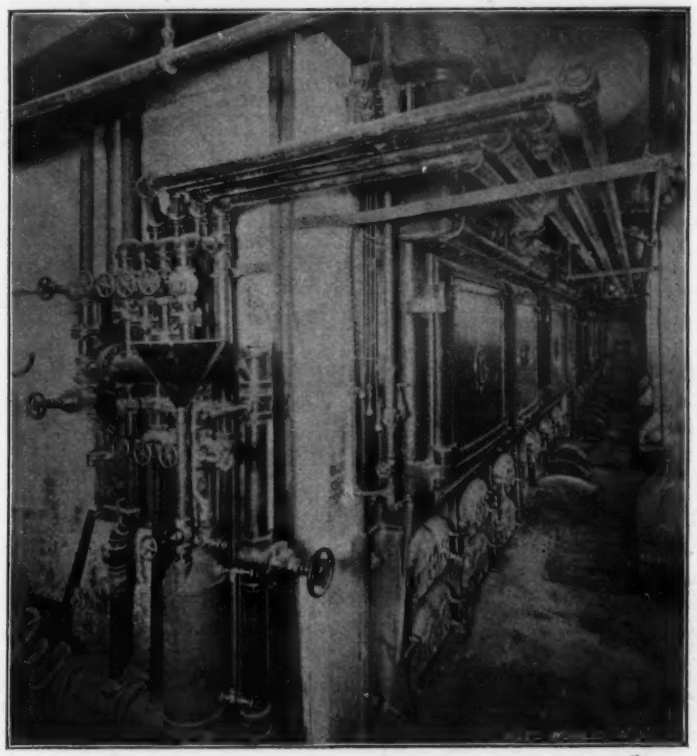
Situated in the heart of the business portion of the city, covering an entire square bounded by four principal business thoroughfares, and rising to a height of ten stories, the Ellicott Square constitutes one of the most imposing structures of a modern progressive city. The building is an example of the best type of modern steel construction, finished in a style of architecture that may be described as Italian Renaissance.

Within as without, the purpose of securing the greatest convenience and comfort, with an unobtrusive elegance of detail, characterizes the design. The distinguishing feature is the great central court which gives abundant light and air to all the interior offices, and provides a social and business exchange large enough f - mass meetings. The court is roofed over with glass on a level with the third floor. Surrounding the court and on a level with the second floor is a balcony approached by two grand staircases.

The first floor is given up to stores, most of which open both on the street and on the central court. The second is the banking



ONE CORNER OF THE BASEMENT.



VIEW OF THE BOILER PLANT.

floor, and above are no less than 600 model offices, approached by fifteen passenger elevators.

The general arrangement of the mechanical plant is shown by the basement floor plan. The boiler capacity of the plant is 1000 horsepower, made up of four Geary steel water-tube boilers installed by the present firm of Irlbacker & Sons, formerly Irlbacker & Davis, who also did all the high and low pressure steam fitting. Water is supplied to the boilers from the city mains, the purification of feed water being effected inside the boilers by the Binks system.

The boilers are equipped with a forced draft system installed by the Buffalo Forge Company. This apparatus consists of a 110-inch fan driven by an 8 x 8-inch horizontal engine. One of the minor details which adds to the economy of the plant appears here. The engine room of a plant naturally becomes over-heated and requires ventilation. This is accomplished in this case by taking air at a temperature above 100° from near the ceiling of the engine room to supply the forced draft, thus serving the double purpose of cooling the engine room and at the same time utilizing the heated air under the boilers.

The feature of this part of this plant is the forced draft regulation, inasmuch as to it is due much of the economy which distinguishes the plant. The question of whether or not forced draft is a desirable acquisition to a steam plant has in the past been a doubtful one except in special cases, for the reason that the control of the blower has usually been left in the hands of the fireman, who often made use of it to lighten his own labors; at times running the blower very fast to avoid working the fire, and again throwing in coal when it was not needed and speeding up the blower until the fresh coal was thoroughly ignited and the fire hotter than necessary, in order that he might sit down and enjoy his leisure. This naturally resulted in very poor economy, and the great changes of furnace temperature were injurious to the boilers. The use of forced draft permits the use of a cheap grade of fuel, the blower in this case furnishing the necessary force to overcome the resistance of the bed of fine fuel.

The system of regulation used is the invention of the engineer in charge, Mr. John Beckman, and is known as the Beckman system. It depends upon the action of three valves. A regulating valve is placed on the inlet pipe to the engine which drives the blower. This valve is so arranged as to open and increase the speed of the blower engine as the pressure of the steam in the boiler falls below the desired point, and to close and decrease the speed as the pressure rises. A pressure-reducing valve is placed in series with the regulating valve to limit the high speed of the fan and to set the draught pressure in such a manner as to produce the most efficient combustion and create under the boiler the greatest heat that the water is capable of absorbing. The stack damper is set to hold back this heat so that the escaping gases do not leave the uptake at more than 100° above the temperature of the steam.

When the steam pressure in the boiler has reached the desired point the regulating valve cuts off the direct supply of steam to the blower engine, and the fan would stop but for the introduction of a by-pass consisting of a small pipe supplied with a reducing valve. By this means steam just sufficient to keep the fan revolving, and at a low pressure of 6 or 8 pounds, is supplied to the engine. Thus the fires are kept bright and the grates cool, while the possibility of the engine stopping on centre is obviated.

The combustion varies directly with the demand, and the regulation is as thoroughly automatic as that of a well-designed engine subject to varying loads, and is accomplished on the same principle. The fuel used consists of hard and soft coal screenings mixed in judicious proportions; three parts of the former to one of the latter is a commonly used mixture. When much heat is required the

proportion of bituminous coal may be increased, but with low fires too much smoke would be created and a return to the first-mentioned proportions is desirable. The limit of variation of the boiler pressure is found to be only about three pounds. With reasonable care in adapting the fuel to the conditions of the outside atmosphere there is practically no smoke, and the cost of fuel per horse-power is reduced to a low figure.

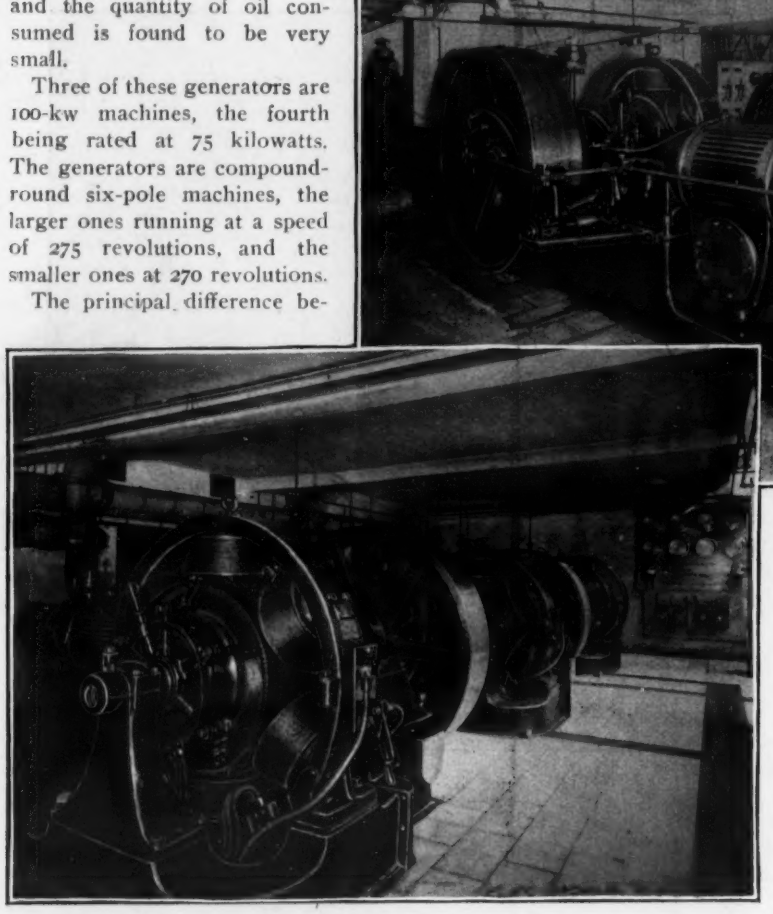
The engine room is of comfortable dimensions, 70 x 32 feet, conveniently arranged and well kept. Power is furnished by four Ball & Wood engines, of which three are rated at 160 horse-power each and one at 100 horse-power. All are of the horizontal tandem compound type and each is direct connected to a General Electric generator of suitable capacity. The high and low pressure cylinders of the larger engines are respectively 11 and 16 inches, and of the smaller engines 8 and 12 inches. All have a 14-inch stroke.

A feature of the engines is the extremely sensitive governor, which is of the inertia type and has a swinging eccentric. The eccentric centre moves across the end of the shaft about an outside point, giving a lead which varies with the point of cut off, from a maximum at the latest point to zero when the governor weights occupy their extreme outward position. The engines run very smoothly, with practically no variation of speed from no load to full load.

Oil is supplied to the engine from a central reservoir, from which the oil is conducted through a filter to the wearing surfaces and bearings, where it is fed through adjustable sight feeds. The oil drains from the engines and is pumped back to the tank; thus there is no waste, and the quantity of oil consumed is found to be very small.

Three of these generators are 100-kw machines, the fourth being rated at 75 kilowatts. The generators are compound-round six-pole machines, the larger ones running at a speed of 275 revolutions, and the smaller ones at 270 revolutions.

The principal difference between these machines and those of the same type designed later by the same company is that the commutators are now made larger and longer, and carbon brushes are used instead of copper gauze.

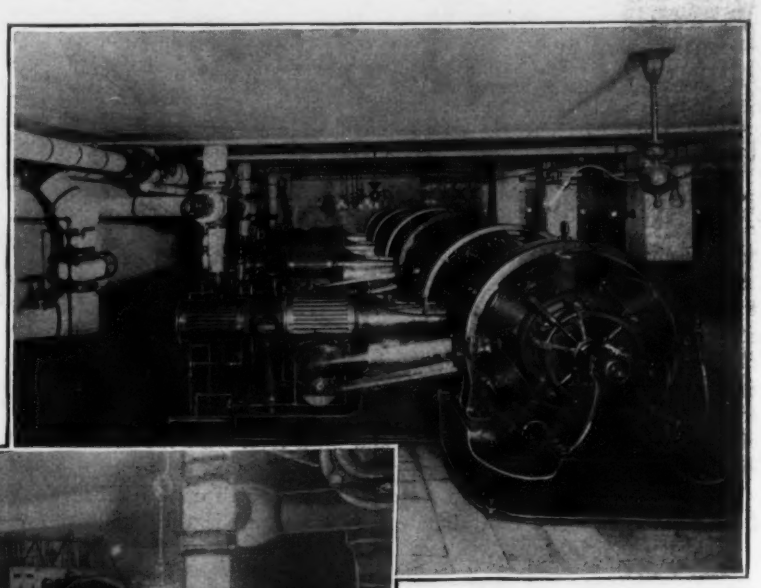


Three Views of the Generating Units.

These machines are designed to maintain a constant pressure and their regulation is important for the reason that a part of the current is suplied to the motor generators of the Western Union Telegraph Company, as explained below. This constant pressure is fixed at 113 volts.

On the switchboard is the usual equipment of ammeters, voltmeter and the ground detectors, to which circuit breakers are to be added. The tasteful simplicity of the switchboard design is to be commended, but it would seem that in a plant of the size of this one, and where extreme regulation is a feature, the designer might have shown better forethought than to place the rheostat handles so near the floor that a man goes down on his knees to adjust them, which leaves the electrical instruments high above his head.

From the switchboard the current is carried by four main feeders which supply the four quarters into which vertical planes may be conceived to divide the building, and four auxiliary feeders, two of which supply the corridor lights, the other two furnishing current to the motors which run the ventilating fans in the attic. The



building, as previously stated, is ten stories high. Each of the four quarters of the building has its centre of electrical distribution on the fifth floor, whence branches convey the currents upward and downward. On each floor are four panel boards from which the conductors run to the various lamp circuits.

No less than 7000 incandescent lamps are wired to receive the current from the dynamos, while at night the central court is lighted by two large electroliers, each comprising five arc lamps. In the large restaurant in the basement are twelve other arc lamps.

There are several other demands on the current generated by the plant beside that used for lighting purposes. In the attic are seven motors driving ventilating fans, each of which require about 40 amperes. In the rooms of the Business Women's Club is a motor driving a pressure blower which demands about 12 amperes. A 100-inch fan used for kitchen ventilation in the basement is run by a motor at an expenditure of about 100 amperes, and motors are also used to drive ice-cream freezers and ironing machines.

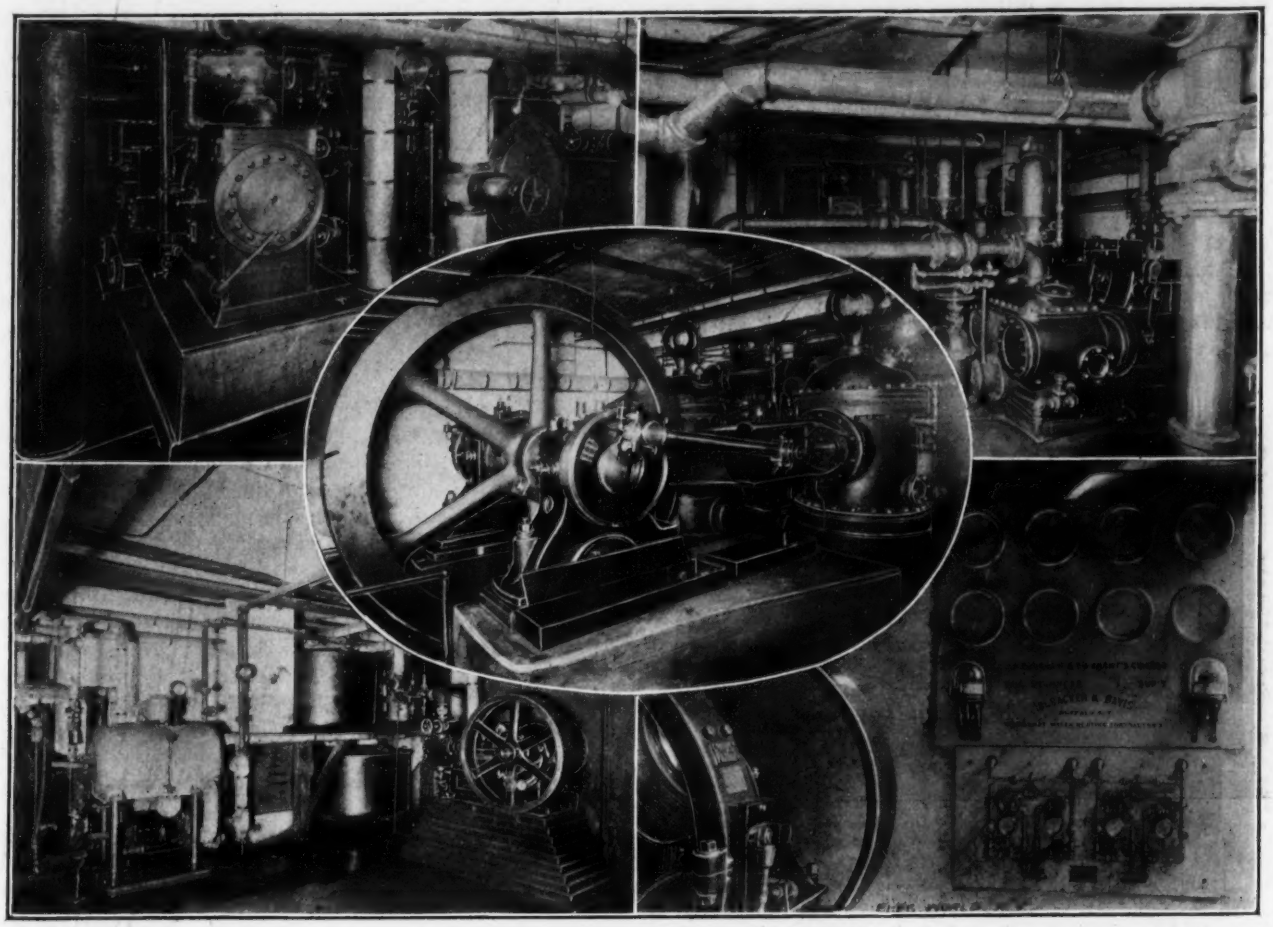
Nearly half of the top floor of the building is occupied by the Ellicott Club with its several hundred members. The remainder is given up to the Western Union Telegraph Company. Since the modern dynamo has displaced the battery in telegraphy the current for a large station is obtained from the most convenient source, which can be depended upon continuously, and which shall be properly regulated to yield a constant pressure.

The Ellicott Square plant supplies the telegraph system a current averaging about 60 amperes at a constant pressure of 112 volts. Current at this pressure is supplied to motor-generators, of which there are nineteen in all, changing it to pressures of 6, 20, 80, 160, 240 and 320 volts, according as local or long distance circuits are to be operated. About 1200 lamps are used as resistances, about two ohms per volt being inserted in each circuit, so that the maximum current even on short-circuit beyond these lamps could be only half an ampere.

In the large operating room there are constantly being received

over the various wires messages which must be sent out from another part of the room. In order to distribute the messages to the proper operators with certainty and despatch a system of automatic carriers is used. Across one end of the room is a gallery in which is an electric motor operating the carriers. These carriers are run upon suitable overhead tracks, and are so arranged that it is only necessary to place a message in the proper compartment at any one of the nine stations in different parts of the room, where it is grasped by the passing carrier, hurried along the line and dropped unerringly at the right station, whence a clerk hands it to the proper operator near by. The current supplied to the motor which runs this system of carriers averages about 5 amperes.

As it is essential that the operation of telegraph lines be continuous, every precaution must be taken to guard against any interruption of the current. The whole plant is in duplicate. Only a direct current can be used, and as no outside source of direct current was available which could be relied upon in an emergency a rotary transformer was installed, which, if necessary, may be used to transform the alternating currents of the city lighting circuit to direct currents for the operation of the station. Superintendent Kitton states, however, that no occasion for using the rotary has yet arisen, the operation of the isolated plant having been continuous since its completion nearly two years ago.



Some Views of the Pumps.

Adjacent to the engine room is the pump room, where are arranged the various pumps which constitute an interesting part of the plant. The general arrangement is shown by the basement floor plan. Occupying the entire west end of the pump room is the large fly-wheel engine which operates the sixteen hydraulic passenger elevators and four sidewalk lifts. Next in order are three auxillary duplex pumps, kept in readiness for use in case of any trouble with the large pump. Ordinarily the large pump is run for ten hours during the day, one of the duplex pumps being run during the night to furnish power to the two passenger elevators which do night service. The additional pump-room equipment consists of two boiler-feed pumps, one house pump, beside two pumps and automatic receivers for returning water of condensation to the boilers.

The fly-wheel engine is a departure from recognized practice, and is worthy of some description. It is a specially designed horizontal, cross-compound, high-duty non-condensing pumping engine, built by the Snow Steam Pump Works of Buffalo. The engine has a high-pressure cylinder 22 inches in diameter, low-pressure cylinder 39 inches in diameter, and double-acting centre-packed plungers 13 inches in diameter, the common stroke being 24 inches.

One of the principal features of the engine is the arrangement of the pump cylinders, which are made up on each side of nine castings. Resting on the foundation is the suction chamber, and on top of this are two suction-valve decks. On top of the two pump barrels are two delivery valve decks and two delivery chambers, the delivery nozzles of which are bolted together in the centre with side nozzles for the final delivery pipes. Placed on the top of each delivery chamber is an air chamber of 30 gallons capacity primed from a 9-inch Westinghouse air pump.

The steam cylinders, which are of the Corliss type and have loose heads in both ends, are tied to the pump cylinders by heavy cast iron cradles, having centre fits on both ends. The cylinders are jacketed all around, the outer and inner shells being in one casting.

The steam pistons are of what is known as the Wheelock type, with adjustable bull rings. The valve gear is of the regular Corliss type, and is made up of steel castings with inserted tool steel wearing surfaces. The cut off in the low-pressure cylinder is at one-third stroke, while the high-pressure cut off may be fixed, or automatically varied by means of a mechanism acted upon by the water pressure.

In a plant of this kind it must sometimes occur that all the elevators are stopped at the same time. To meet this emergency and guard against the engine becoming "stalled" an automatic by-pass is attached to the delivery main between the pump cylinders which, when open, permits the water to pass from the delivery back to the suction pipe in sufficient quantity to keep he engine moving at the rate of about nine revolutions.

The heating system is notable on account of its economy, efficiency and ease of regulation. The entire building is heated by the exhaust steam from the engines and pumps without any back pressure, by the use of system installed by the Paul System Company, of Boston, Mass. As regards the heating system the building is divided by vertical planes into four sections, corresponding to the electric-light wiring, already described.

The exhaust steam at atmospheric pressure is carried to the attic in 16 and 18-inch mains, where it is distributed to the four quarters or sections of the building, the piping being so arranged that

any one of the sections may be cut out without affecting the rest of the system. It is also possible to cut out independently any one of the rising lines, of which there are twenty in each quarter section.

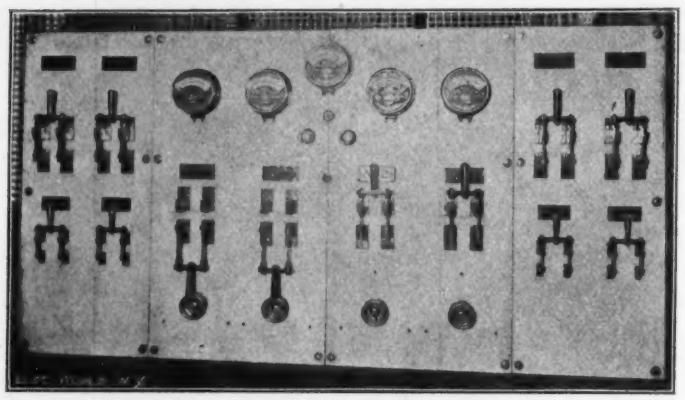
In the basement there are four exhausters corresponding to the four quarters of the building, and so arranged that one can be worked on each section or only one or two on the whole system as occasion requires; or if desired, all four can be worked on one section. The entire circulation is effected at or below atmospheric pressure, with the vacuum at the gauge at 10 to 12 inches.

The total heating surface is 55,000 feet, and there are 100 radiators. The back-pressure valve is in the attic, and the main heating and reducing valves are in the basement. It requires about 5 horse-power to operate the exhausters. The ease with which this system adapts itself to every condition in an enormous building of this kind, and the uniform degree of heat throughout the entire building at all seasons, is very gratifying to the occupants of the building and to those in charge of the plant.

The ventilation of the building is acomplished by means of an exhaust system furnished by the American Blower Company, of Detroit. In the attic are seven disc wheels, each 6 feet in diameter, driven by the electric motors previously mentioned; there are eight ventilating shafts, four of these being elevator pipe shafts, while the space surrounding the smokestack constitutes one. There is found to be at all times a pleasant, uniform circulation of air and no disagreeable draughts.

Principal among the remaining apparatus which use a share of steam from the boilers is the refrigerating plant. Two vertical engines, each 9 x 12, drive ammonia compression machines built by the Case Refrigerating Machine Company, of Buffalo. Each of these machines is rated at 6-tons capacity per twenty-four hours, and requires about 15 horse-power. These cool water for the drinking fountains, and also supply ice and cool the refrigerators of the club on the tenth floor and a restaurant on the first floor.

Considerations of economy require that the condensed water be utilized and this is effected by means of two pumps with auomatic



View of Switchboard.

receivers. All the condensed water from the high and low-pressure system is returned to the boilers, so that there are no heat units lost nor any waste of water.

Few plants are so well equipped for practical tests as this one, and in few cases are the workings of a plant so closely watched and so carefully recorded. In Buffalo, users of power have always in mind that Niagara power is in the market, and all desire to be in a position to know exactly what their power costs.

All the coal consumed by the plant comes to the boilers in small cars which, as they approach the boilers, pass over scales and are accurately weighed. A water meter measures the number of gallons of water supplied from the city mains, while the smallest detail affecting the operaion of the plant appears on the engineer's daily report.

The boilers and system of piping are especially adapted to the requirements of convenient testing. The ring system of piping is used, and steam can be supplied to the engines from two different directions. Accurately calibrated test tanks are provided, and there is a double manifold, so that any boiler can be fed from any tank, while it is possible to cut out and run separately any boiler desired, as for testing the electric-light plant or elevator system. There are valves in the steam header to test each boiler separately.

From considerations of careful tests and from the daily log of the engineer we have the following:

RESULTS.

Water evaporated per pound of coal actual	6.77
Equivalent from and at 212°	8.18
Equivalent water per pound of combustible from and at 212°	9.03
Commercial horse-power of boilers, based on 30 pounds	250.00
Builder's rating	250.00
Average amount of steam supplied electric light engine per electric hp hour pounds	36.73
Average output for 8760 hours (365 days), kilowatts	77.99
Heaviest load, kilowatts	260.00
Average coal per ampere hour, water supplied at 56 degrees, pounds	.842
Average coal per ampere hour, water supplied at 183 degrees, pounds	.75

The plant as a whole is made up of well-constructed machinery, properly designed for the use to which it is put, while no small part of the gratifying results which are obtained is due to good judgment and close atention on the part of the chief engineer and his assistants.

The building and site complete cost $3,350,000, and are owned by the Ellicott Square Company, of which Mr. John N. Scatcherd is president. It has always been regarded in the light of a public enterprise, and is a source of pride to the people of the Electric City. D. H. Burnham & Co., of Boston, are the architects, while the plant was designed by Jonathan Clark, Sons & Co., of Chicago.

Some Ingenious Applications of Electricity in Warfare.

Some amusingly imaginative devices for the use of electricity have been brought out by a no less grim cause than the present international difficulty. The so-called "inventions" for the application of electrical devices to purposes of destruction have been far more ridiculous than promising up to date. The Patent Office has received many such applications and the vivid accounts given in the daily press by the combined efforts of the inventors and imaginative writers have tended to show that by means of a few simple devices everything Spanish can be destroyed by the pressure of a button.

One of the amusing things in this line is a means of exploding a mine by a current transmitted without wires. As described and shown pictorially, the mine is provided with an electric fuse connected in a circuit running from the mine itself to a plate in the anchor. Near the shore there is a plate buried in the ground and another plate floating in the water. A current passed between the latter two is represented as running out from the plate in the water to the mine, thence through the fusible detonator to the ground and through the ground back to the ground plate. It is apparently considered that the bottom of the ocean is covered with an insulating sheet which will prevent the current passing from the water to the ground in any quantity by any other path but via the fuse.

Another device represents the old and well-known selenium cell for telephonic purposes, arranged in the fighting top of a ship and operated by a focused beam from a diaphragm vibrated by the voice in the fighting top of another ship alleged to be 10 miles away. The selenium cell would not subtend a very great spherical angle at a distance of 10 miles, and with the rolling and pitching of the ship the beam would probably strike it about 1-100th of a second in a week. The fact is set forth that "every word is heard."

It is also proposed, apparently by the same brilliant mind, to mine a roadstead with magnets which shall seize a hostile ship and hold her motionless.

One of the most lurid of these proposals is headed "We May Fight with Lightning Bolts." By this plan it is naively proposed to stretch a wire between towers across any ship's course, at such points, for instance, as between "'Sandy Hook and Rockaway Beach," a matter of about 10 miles. On this wire there is to be an electrical engine, which may be moved from the shore to a point directly over any ship attempting to pass below. The electrical engine is arranged to discharge its "bolt vertically upon the deck of the vessel, tearing its way clear through to the water," and it is estimated that the bolt will strike with a force of 50,000 foot tons and can be discharged three times in a second. This would obviously require, assuming a perfect efficiency, an expenditure of about 600,000 horse-power. The means of supporting a cable 10 miles in length and protecting it from hostile fire are not stated.

Other plans contemplate the establishment of complete telephone systems between the various ships of a fleet by means of wires supported by kites and similar devices, and, of course, wireless telegraphy comes in for its due share of attention.

The Calculation of Transformer Efficiencies.

A simple method of deriving the efficiency of a transformer at any load, having given a few factors which are easily derived, is described in a contribution by Alexander Russell in the London "Electrician," March 25, and from this contribution the following points have been abstracted:

The method applies to alternating current transformers, both of the closed and open iron circuit types, and by its use the labor of testing a transformer is greatly simplified. From the construction given below, it will be seen that the efficiency curve is compounded from an equiaxial (rectangular) hyperbola and a straight line. In some drawing offices flat pieces of wood cut into the shape of these curves are used for studying indicator diagrams, etc., and these can be conveniently used for drawing the hyperbolas. If these are not obtainable, the curves can be very quickly drawn on sectional paper by calculating points on them, or they can be drawn by several graphical constructions.

The data required to construct the efficiency curve are—(1) V, the effective primary volts; (2) w, the watts expended on the primary when the secondary is open circuited; and (3) $R + n^2 S$, where R and S are the resistances of the primary and secondary circuits respectively, and n is the ratio of the primary to the secondary windings. For convenience we shall write Q for $R + n^2 S$.

Draw as in the diagram two lines, $O\ T$ and $O\ E$, at right angles to one another and measure loads in kilowatts on the primary along

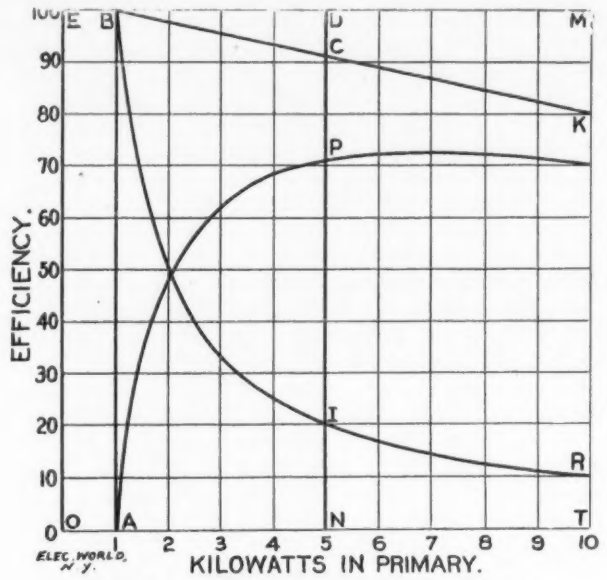


DIAGRAM OF TRANSFORMER LOSS RATIOS.

$O\ T$ and percentage efficiencies aong $O\ E$. Mark $O\ A = w$ and draw $A\ B$ equal to a hundred on some convenient scale. Through B draw an equiaxial hyperbola $B\ I$, having $O\ T$ and $O\ E$ as its asymptotes. Let $O\ T$ be the maximum load and draw $T\ M$ equal to $A\ B$, and make $M\ K$ equal to $100Q(W - \omega) \div V^2$, where W equals $1000 \times O\ T$, and is the maximum power given to the transformer in watts. Join $B\ K$. Then the efficiency curve $A\ P$ is got by making $P\ N = C\ N - I\ N$. It follows that $C\ P$ equals $I\ N$.

The justification of this construction is given by the author in an elaborate mathematical demonstration, the main points of which can be stated as follows:

The method is based on the assumptions that the iron loss is constant at any and all loads and that the copper losses are proportional to the square of the primary input minus the iron losses. The first assumption may not be quite correct, owing to the magnetic leakage and the slightly reduced induction with increased load and constant impressed E. M. F., and the second assumption is also not quite true, owing to the fact that there is, so to speak, superposed on the primary energy current, which is proportional to the square of the load, a magnetizing current in quadrature therewith and practically independent of the load. This magnetizing current while small in transformers with a closed magnetic circuit is considerable in transformers of the so-called "hedgehog" type. Under these assumptions, however, it is obvious that the $C^2\ R$ loss in the windings is proportional to the square of the load and that its ratio to the load is proportional to the first power of the latter. This loss ratio may, therefore, be laid out as a straight line $B\ K$, $M\ K$ being the ratio of the copper loss to the primary input at load $O\ T$.

The iron loss being constant, its ratio to the output will be inversely proportional to the latter and may, therefore, be represented by a rectangular hyperbola $B\ I\ R$ asymptotic to the two co-ordinates and further located by the rule that every point must have an ordinate equal to the ratio of the iron loss to its abscissa. Thus the ordinate for a load of 2 kilowatts is 50 per cent., of 5 kilowatts 20 per cent., etc., the iron loss being 1 kilowatt.

At any load, then, such as 5 kilowatts in the primary, the ratio of the iron loss to the input is $I\ N$ or 20 per cent.; the ratio of the copper loss to the input is $C\ D$, or about 9 per cent.; the ratio of the output to the input, or the efficiency, is $D\ N$, 100 per cent. minus $(I\ N + C\ D)$. By the construction $C\ P = I\ N$, therefore, $P\ N$ is the efficiency at that load. In the same way the efficiency at a number of loads sufficient to determine the curve can be graphically laid out in a few minutes' time.

In the case assumed the losses have been greatly exaggerated in order to accentuate peculiarities in the shape of the efficiency curve. In modern transformers $M\ K$ is about 2 per cent. of $M\ T$ and $O\ A$ is about 2 per cent of $O\ T$. A study of this diagram is instructive, as it shows the effect that the various losses have on the efficiency of the transformer.

The point of maximum efficiency is obviously at such a load that the inclination or tangent of the hyperbola is the same as that of the line $B\ K$. As the load runs down below this, the ratio of the iron losses to the load increases faster than that of the copper losses decreases, and as the loads run above this, the ratio of the copper losses increases faster than the ratio of the iron losses diminishes.

A variation of the ohmic resistance practically only varies the inclination of the line $B\ K$ to $B\ M$. Hence diminishing the resistance increases the efficiency at every load, but makes the maximum efficiency come at a heavier load.

Diminishing the hysteresis and eddy current losses in the core (w), keeping the resistance constant, increases the efficiency. The new equiaxial hyperbola has smaller axes and fits more nearly into the angle $E\ O\ T$. It is also easy to see that the maximum efficiency comes at a lighter load.

If it is desired to increase the efficiency at a load below the load at which the efficiency is a maximum, a given percentage diminution of iron is more effective; at higher loads diminishing the copper loss has more effect on the efficiency.

In the above construction it has been assumed that the resistance of the copper remains constant. Owing to the rise of temperature the resistance of the copper is from 10 to 15 per cent. more at full load than at no load. To take this into account, however, is only necessary at high loads, for even at the maximum load the error introduced into the determination of the efficiency by neglecting this rise of temperature is only from 0.1 to 0.3 per cent. We have merely to increase $M\ K$ by 10 or 15 per cent. and draw a curve through the new K tangent to $B\ C$ at B.

It is a very instructive exercise to take a tabulated list of the efficiencies of a given transformer at various loads, and see how they agree with the efficiencies got by the graphical construction. Another use of the curve is to test experimental results, and by plotting the efficiency curve through as many points as possible to see if the core loss has been accurately measured.

In order to know how a transformer will work on the mains of a given supply station it is necessary to know, among other things, the magnetizing current it will take and the core losses when there is no load on the secondary. Both of these depend on the shape of the wave of the applied E. M. F., and this shape is by no means constant, but depends on what machines are running at the central station. They also depend on the frequency, and this has a way of varying. Hence for a particular transformer there are in practice a series of curves of efficiency depending on the shape of the wave and the frequency.

To calculate the effect of a variation of the frequency is easy, and the core losses with waves of different shape can be got experimentally. The variations due to this cause in the values of the core losses and the magnetizing current may sometimes vary 10 or 15 per cent. Manufacturers ought therefore to state the alternator used to magnetize their transformers during their tests. Another point that has to be attended to is whether the transformer will age or not, as in some cases the core losses will increase for some months after the transformer has been placed in the circuit. Hence some engineers ask the manufacturers to state a maximum for the watts required to magnetize the transformer after it has been in use for six months.

Oscillatory Currents and Some of Their Phenomena—I.

BY PROF. E. F. NORTHRUP.

Intense interest has of late been aroused in the many striking phenomena connected with oscillatory currents. This interest was first awakened among professional electricians and physicists by the extraordinary experiments of Hertz, later the general public became excited over the fairy-like effects obtained by Tesla, with his currents of high potential and high frequency, and now comes the production of the X-rays, which have forced a large body of scientists, the doctors and surgeons, to give their attention to electrical matters. Marconi's wireless telegraphy, an outgrowth of the experiments of Hertz and Lodge with oscillatory currents, is likewise exciting general attention. The interest felt in these matters is extended, but people's notions are in general vague as to the methods used for obtaining the effects, or the principles upon which they depend.

It is, however, surprising to note how many of the phenomena of oscillatory currents may be explained and connected by a right application of a very few simple physical principles with which everyone is instinctively acquainted. Furthermore many of the most interesting results may be obtained by any one who has a little ingenuity, clear physical conceptions, a few dollars and a room in which to experiment. It is feasible for every doctor using X-ray apparatus, and station-tender who has the disposal of alternating or direct currents, to rig up the necessary simple apparatus to repeat experiments along this line and to materially contribute to the general fund of knowledge upon the subject.

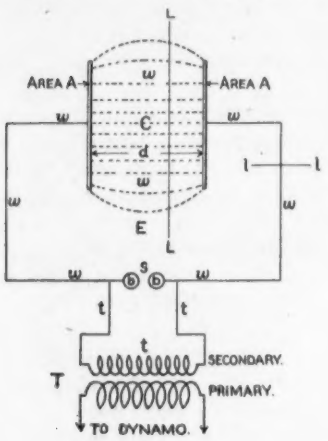


Fig. 1.

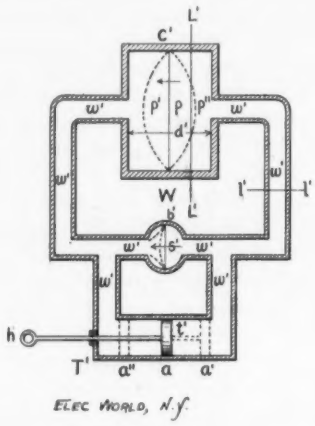


Fig. 2.

The writer will try and describe for the above class of readers of The Electrical World, in a simple non-mathematical manner and as far as possible non-technical form, the general methods and the construction of the necessary apparatus for obtaining oscillatory currents and their effects. He shall feel well repaid for his undertaking if doctors and others are induced to try for themselves some of the experiments to be described, and if they derive from their efforts a share of the delight which he felt when experimenting along the same line.

A clear physical conception of what constitutes an oscillatory current should be obtained before the attempt is made to describe what may be done with such currents. This may justify the somewhat lengthy description which follows:

A common arrangement for obtaining an oscillatory current is diagrammatically illustrated in Fig. 1. Here C is a condenser, which may be considered as consisting of two square brass plates, having each an area A parallel and separated from each other by a distance d. T is a transformer, from the secondary of which a high-potential current, of 20,000 volts, say, may be obtained. b b are two metal balls, separated from each other about one-quarter inch. When a low-voltage slowly alternating current is sent through the primary of the transformer, the high voltage induced in the secondary of the transformer causes a discharge to pass across the air gap s, and an oscillatory current, that is, a current which, so to speak, swings back and forth in opposite directions like a pendulum, is found to exist in the circuit w (including the insulating space between the plates of the condenser). In the circuit t the current is slowly alternating, while in the circuit w the current is rapidly oscillating.

Several important characteristics of this oscillatory current may be understood by any one not an electrician by considering the water analogue which is illustrated in Fig. 2. Here the arrangement to be described is shown in section. w' w', etc., is a system of iron pipes. C' is an iron box, its dimension perpendicular to the plane of the paper being, say, the same as its width, d'. Dividing this box into two compartments is an elastic rubber partition, P. This partition under pressure may be strained so as to take the position P' or P''. Across the enlarged portion of the pipe, b', is a partition, s'. This partition is likewise supposed to consist of rubber which will yield a trifle under moderate pressure and suddenly break when the pressure becomes great. The piston t' may be moved by the handle h back and forth in the cylinder T'. At the start let the piston have the position a, let s' be intact and P in its normal position. Conceive the whole system, pipe, cylinder and box, completely filled with water,, which is a practically incompressible fluid. Now grasp the handle and push the piston toward the right. The water pressure upon the left hand side of the diaphragms P and s' will be decreased and the pressure upon the right hand side will be increased. As the piston approaches nearer to the position a', shown in dotted lines, the elastic diaphragms P and s' will be strained more and more to the left. When the piston has reached a' suppose P to be strained into the position P' and suppose the strain upon s' to have become so great that it very suddenly breaks. The instant s' breaks the pressure is released upon the right hand side of P', and hence the water is forced to move out of the right hand side of the box, through the circuit of pipe w', around into the left hand side of the box. Note that the velocity with which the water flows in the pipe circuit continues to increase until the force urging the water on ceases to act. This force is the elastic reaction of the partition P. The velocity will evidently be greatest when the diaphragm is in its normal position P. Since, however, the water is now in rapid motion it cannot suddenly come to rest, hence it continues to move in the same direction until it has forced the elastic diaphragm into the position P''. The direction of motion of the water is then reversed. It surges back again in the opposite direction; the original motion is then repeated and so on. These back and forth oscillations of the mass of water, however, grow less and less extended, on account of the decay of the motion due to the friction of the water against the sides of the pipe, until after a greater or less time the water comes to rest. Now imagine that a new diaphragm s' is suddenly created and that the piston continues to be moved very slowly back and forth. In whatever direction this piston is moved a pressure must finally be produced on s' which will burst it, and the above series of oscillations of the water be repeated. If the piston continues to move back and forth with a regular motion and the diaphragm s' is magically restored whenever the surging water comes to rest, there will be a continued series of oscillations of a mass of water, which illustrate and obey many of the laws of the oscillations of electricity which occur in the electric circuit illustrated in Fig. 1.

The principal points of similarity between the electric and the water circuits are as follows: The rougher is the interior surface of the water pipe w' the greater will be the friction of the water against this surface and the more rapidly will the oscillations of the water die out. This roughness of the pipe corresponds to the quality of the wire forming the electric circuit, one of the factors which determines its ohmic resistance. The electric oscillations would die out quicker in a circuit made of iron wire than in one made of copper wire. If the ohmic resistance of the electric circuit is greater than a certain amount the oscillations will not exist at all.

The time which it takes for the column of water to make one complete oscillation, that is, for the diaphragm P to move from its position P' to P'' and back again to P', is seen plainly to be dependent upon two circumstances, the mass of water which moves back and forth and the elasticity, as well as the area of the partition P. If the pipes in which the water oscillates are long, the oscillations are necessarily slower than if they are short. The time for a complete oscillation to take place will also be greater when the diaphragm P is very yielding than when it is les so. A stiff diaphragm of small area will urge the water back and forth more quickly than one of large area and very elastic.

In the electric circuit there is something which corresponds to the mass of the water in the water circuit in determining the time which is required for a complete oscillation of the electricity to take place. This something is the medium surrounding the circuit and bears no resemblance to the water except in having inertia. When the electricity is said to flow in the wire more or less of this medium is in motion. The mass of this medium which is in motion when a current of electricity flows depends upon the length of the wire and

the way in which it is coiled up, just as the mass of the water depends upon the length and diameter of the water pipe. The velocity of the motion of the medium is proportional to the strength of the electric current which is said to flow in the wire. This motion of the medium which surrounds the circuit is made manifest in the so-called lines of magnetic force. When a unit quantity of current sets in motion a certain mass of the medium surrounding the electric circuit, the circuit is said to have a certain inductance or coefficient of self induction. This inductance of the circuit then is represented in the water analogue by the mass of the water, and as the period of oscillation of the water is proportional to its mass, so the period of oscillation of the electricity is proportional to the self inductance of the electric circuit. The longer the wire and the more it is coiled up the greater this will be.

In the electric circuit just before the E. M. F. or force which urges electricity into motion becomes great enough to break down the thin air gap between the balls, this being represented by the partition *s'* in the water analogue, there is a strained condition of the medium between the two condenser plates. This is produced by the E. M. F. acting across the space between these plates just as the water-pressure force acts on the diaphragm *P* to strain it.

Now a particular thickness of medium or dielectric, as it is called, will be strained out of its normal condition by a certain E. M. F. by an amount which depends upon its nature, the same as a certain thickness of rubber diaphragm will be strained from its normal position under a given water pressure by an amount depending upon its flexibility. The amount of strain produced in both cases will be less the greater is the thickness of the substance strained. Evidently then the nearer the condenser plates are together the greater will

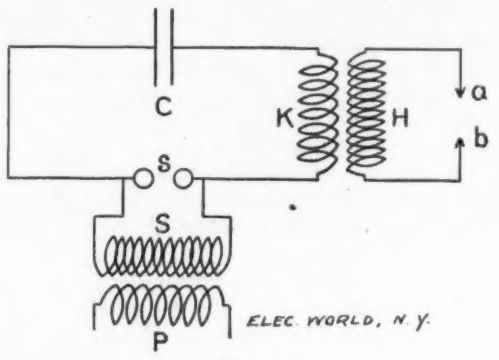


FIG. 3.

the dielectric between the plates be strained or displaced and the greater will be the quantity of electricity which will have been moved across any imaginary plane, as *L L*. Likewise a greater quantity of water will move across any imaginary plane *L' L'* under a given pressure when the rubber partition is made more yielding. Note also the important fact that under a given pressure of the piston as large a quantity of water is forced across any imaginary plane *l' l'* as across any other imaginary plane, as *L' L'*. In the same way as large a quantity of electricity crosses one section of the circuit as any other. In short, as much electricity moves across the portion of the circuit which is made up of a so-called insulator as moves across any section of the conducting portion.

We may tabulate as follows the conditions which govern alike the oscillations in the water circuit and the electric circuit:

WATER CIRCUIT.	ELECTRIC CIRCUIT.
Roughness of interior of pipe.	Resistance of wire due to quality.

These determine the rate at which the oscillations die out.

WATER CIRCUIT.	ELECTRIC CIRCUIT.
Mass of water in circuit.	Mass of medium in motion when current flows or self inductance of the circuit.
Flexibility of diaphragm *P*.	Capacity of electric condenser.

These determine the time during which a complete oscillation occurs.

WATER CIRCUIT.	ELECTRIC CIRCUIT.
Pressure which piston can produce.	E. M. F. of transformer.
Length of air gap *S'*.	Strength of partition *S*

From the above comparisons it is seen that greatness of area of the condenser plates and their nearness together, or in electrical language, greatness of capacity, corresponds to greatness of elasticity and area of the rubber diaphragm, and hence the greater is the capacity of the electric condenser the slower will be the oscillations in the electric circuit. The sudden restorations supposed for the diaphragm *s'* are actually accomplished in the electric circuit by the inrush of cold non-conducting air as often as the oscillations in the circuit *w* have died out.

Let a circuit now be arranged as in Fig. 3. This circuit is supposed to be like that of Fig. 1 in all respects, except that at *K* the wire is wound into a coil or solenoid of eight or ten turns. Another coil of fine wire, *H*, is supposed to be wound around the coil *K*. When an oscillatory current now passes through the coil *K* a current is induced in the coil *H*. No known mechanical analogue can well illustrate of explain why a varying current of electricity in one circuit will induce or cause a current to flow in a neighboring circuit. Such, however, is the fact, the discovery of which added lustre to the already immortal name of Faraday. What concerns us here is that the force with which the electricity in the coil *H* is urged forward is, in the case illustrated above, very great. The high E. M. F. which is induced in the coil *H* is due to the very rapid rate at which its turns are cut by the magnetic lines which are produced by the oscillating current flowing in the coil *K*. When the circuit in the coil *K* has its maximum value there is a maximum number of lines of induction in the space about the two coils. When the condenser *C* is fully charged, and there is no current in the coil *K* then there are no lines of induction in the field. Now, if the two coils are wound so as to be close together and well insulated from each other, the lines of induction, which come into and go out of the field as the current in *K* rapidly changes its value and direction must all cut the turns of the coil *H*. These turns will be cut twice every time the current in the inducing circuit makes a swing in one direction; once as the current rises from zero to its maximum value and once as it again sinks to zero. Since the oscillations of the current take place with enormous rapidity, the turns of *H* are cut by the magnetic lines of induction with a like rapidity. It is an experimentally determined fact that the E. M. F. set up in a circuit which is being cut by lines of induction is proportional to the number of such lines per second which cut it, or as usually expressed, to the rate of change of induction through the circuit; hence in the circuit which includes the coil *H* the E. M. F. induced is very great. For example, the E. M. F. induced in *H* will be sufficient to produce an 8 or even a 10-inch discharge through air between the terminals *a* and *b*, when the circuits have approximately the following proportions: From the secondary *S*, of the transformer *T*, a sufficient E. M. F. must be obtained to discharge across the discharge gap *s* when a quarter of an inch long. The condenser *C* must have a capacity of about one two-hundredth of a microfarad, or a capacity such as would be obtained by stacking up about forty sheets of double thick window glass 10 by 10 inches and thirty-nine sheets of tin or copper. The coil *K* may have about ten turns of heavy wire and the coil *H* about 500 turns of fine wire. The current in *H*, of course, changes its direction with the same frequency as the current in *K*; that is, some millions of time in a second. The discharge from the coil *H* is what has been popularly called the Tesla current of high potential and high frequency. It may be remarked here, however, that phenomena of this class have been studied and developed in quite as able a manner by Prof. Elihu Thomson.

Before attempting to explain the effects, uses and practical methods of producing oscillatory currents it may be well to show diagrammatically the various arrangements of circuits which will give rise to such currents.

In Fig. 4 *D* is a direct current dynamo. The higher the voltage of this dynamo the better, for the effects to be described are increased in proportion to the square of the voltage; 500 volt machines used to operate electric street lines will give powerful effects. *C* is a condenser made of paper and tinfoil soaked in wax and having a very great capacity. *P* is a coil of a dozen or more turns, and *S* is a coil of several thousand turns. *K* is a device for alternating, allowing the condenser *C* to be charged by the dynamo, and for closing the circuit through the coil *P*, so the charged condenser can discharge through the coil. It operates as follows: *a a* and *b b* are strips of metal fastened on a cylinder of wood or hard rubber and cross-connected as shown. *n' n' n n* are four brushes which bear upon the cylinder, and have the relative positions shown in the

diagram. It will be easily seen that if the cylinder is made to rapidly rotate in the direction of the arrow that when the brushes *n n* bear on two conducting pieces the condenser is in circuit with the dynamo and is being charged, and that the coil *P* is out of circuit, and that when the two brushes *n' n'* bear upon conducting pieces the condenser is in circuit with the coil *P*, and that it will then discharge through the coil, the dynamo then being out of circuit with the condenser. When, however, the condenser discharges an oscillation of electricity will take place through the coil *P* in the same way and for the same reason that it did in Fig. 1.

The oscillatory current in *P* will induce an oscillatory current of the same frequency in the coil *S*. If the coil *S* has many turns the current induced in it will be urged forward with a very high E. M. F., so that a long discharge may be obtained between the terminals *p p'*. Since, however, the condenser *C*, for reasons to be explained, must be made very large, the oscillations in the coil *P* will be very much slower than in the case of the circuit of Fig. 1, which is supposed to contain a condenser of small capacity, but charged to such a high degree or potential that it can discharge across an air gap.

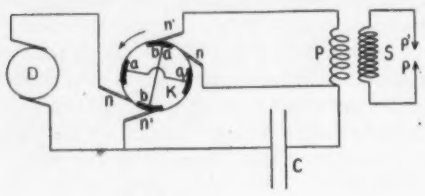


Fig. 4.

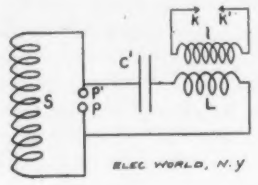


Fig. 5

Since the current swings slowly back and forth through the coil *P*, the rate at which the coil *S* is cut by lines of induction is not very great, and to obtain a high E. M. F. in the coil *S* this coil must have a great many turns of wire. This follows from the well-known principle that the E. M. F. set up in each turn by the inductive action is added to that set up in the other turns. The oscillatory current in the coil *S*, while having a very high potential, or in other words the power to discharge through a considerable length of air, oscillates with comparative slowness. To obtain an extremely rapid oscillation we may modify the circuit as illustrated in Fig. 5.

The terminals of the secondary coil *S* end in two balls, separated from each other about a quarter of an inch. A condenser of small capacity in series with a coil of a half dozen turns is joined to the opposite sides of the discharge gap *p p'*. If *S* then has potential enough to discharge across this gap an oscillatory current of very great frequency will flow in the coil *L*, which, by means of the coil *l*, can be raised or lowered in potential.

The condenser *C*, Fig. 4, must have a very large capacity, for the following reason: The quantity of electricity which any charged condenser contains is proportional to the potential to which it has been charged or to the force, so to speak, with which electricity was forced into it. Referring to Fig. 2 it is evident that the excess of water in the box on one side of the partition *P* over that on the other side will be proportional to the force exerted upon the handle *h* of the piston *t'*. Now this excess of water on one side of the partition *P* corresponds to the quantity of electricity in the condenser *C* of Fig. 1, and the force exerted upon the handle *h* to the potential or E. M. F. of the secondary of the transformer *T* which charges the condenser *C*. Such being the case, if the condenser *C* in Fig. 4 had a small capacity and was only charged by the low E. M. F. of the dynamo *D*, it would contain very little electricity. which, when discharged through the coils *P*, makes a rapid oscillation but produce a current having very little intensity. In short, the condenser *C* would have very little energy stored up in it, and however the relations of the two coils *P* and *S* are adjusted, only a small display of energy could be obtained from the terminals *p p'*. If we attempted to make the discharge between *p p'* long it would be found to be very thin, and if a condenser, *C'*, were connected across its terminals the discharge would be very much shortened, if not eliminated altogether. It can be shown that the energy contained in any condenser is proportional to its capacity and to the square of the potential to which it is charged, so that when working with low potentials very large condensers must be used to obtain effects which exhibit much energy.

The Ballston Terminal Railway.

A novelty in electric railways is now under construction in the northern part of New York State, its peculiarity being that the road, although situated in the open country and designed mainly for freight service, is to be driven electrically. The road is called the Ballston Terminal Railway and runs from Ballston Spa, where it connects with the Delaware & Hudson Railroad system, 12½ miles along the Kyaderroseras Creek to Middle Grove, passing on the way many large paper and pulp mills, which it is intended to serve. The road is single track built mainly on private right of way, and is constructed on regular steam railroad lines, with 70-pound steel T rails, standard ties and gravel ballast. The trestles and bridge work are all of standard railway construction, the latter being of steel on masonry foundations. The reasons for adopting electric power were the desire to run the road in places beside the highway where steam locomotives are objectionable, the reduced fire risk in and about the paper mills and their wood yards, and the increased passenger traffic which it is expected can be obtained with the more frequent service possible with the lower train mile charges of the electric system. The electric cars can also overcome better the grades and curves, the reduction of which to steam railroad standards would have been quite expensive on this line. The maximum grade is 2½ per cent. and the sharpest curve has a radius of 150 feet.

Two cars built by the J. G. Brill Company, of Philadelphia, will be put in service on the opening of the road, which will probably take place next month. Each of these cars is fitted with two trucks and the car body is divided into baggage and passenger compartments. The larger is 42 feet long and is to be equipped with four 50-hp Westinghouse motors, one geared to each axle. This car will weigh about 30 tons. The smaller car will be fitted with but two motors of the same size, one on each truck. The larger car is guaranteed to start up a 2½ per cent. grade with two standard railway 60,000-pound cars in tow. It is expected that a schedule speed of about 15 miles an hour can be maintained, and about thirty cars a day in each direction is the amount of freight which can be counted upon. This freight, consisting of raw material and coal coming in and finished paper going out, is at present handled entirely by teams, the roads being anything but the best, and the cost is from 25 cents to $1 a ton, which amounts to considerable in the production of paper.

The power station is situated about 2½ miles from Ballston Spa, the plan being to boost the current for the 10-mile transmission to the other end of the line. The station includes at present two Babcock & Wilcox boilers of 250 horse-power each, one 350-hp Hamilton-Corliss single cylinder engine, belted to a Westinghouse generator. A similar equipment will be added later.

The overhead trolley line will be of 00 wire, double trolleys being carried on the cars. The rails are to be bonded with U-shaped leaf copper flexible bonds, with cast lugs upset in the regular bolt holes nearest the ends of the rails. The bond will be placed under the fish plate, the two centre bolts of the six-hole plate being, of course, omitted. This is done to reduce the theft of copper which is found to be considerable with long exposed bonds on roads of this kind where the bond is above the surface. The necessity for removing the fish plates to get but a short piece of copper and the fact that the removal of a railroad fish plate is a penitentiary offense will probably reduce the attractiveness of these bonds to the enterprising burglar.

The manager of the road is Mr. J. C. Stanton, and the chief engineer, who kindly furnished the information given above, is Mr. A. B. Paine.

Work on the Plant of the Hudson River Power Transmission Company.

The water-power transmission plant at Mechanicville, N. Y., for the deevlopment of power for transmission to the works of the General Electric Company at Schenectady, has almost reached completion. The dam, abutments and power house are practically finished, the turbines are in place, the poles are set for the transmission line and the switchboard and generators are being rapidly finished, one of the latter being already on the ground. The city of Schenectady has objected to the running of the 11,000-volt transmission line through the streets, and it is probable that this part of the line will have to be laid under ground.

The Reconstruction of the Power House of the Union Traction Company of Philadelphia.

The power station of the Union Traction Company, Philadelphia, situated at Thirteenth and Mount Vernon Streets, the destruction of which was described in THE ELECTRICAL WORLD of March 13, 1897, has been gradually reconstructed, and now compares favorably in operating efficiency with any of the large stations of recent design.

After the fire it was found that one of the large machines was damaged chiefly by water, and a temporary roof was therefore constructed over this unit and also over a portion of the boiler room. A temporary switchboard was hastily constructed in another portion of the building, and within ten days from the date of the fire power was being obtained from this station, although, of course, in a largely reduced amount.

The rebuilding of the plant on new lines while portions of it were in operation was obviously a much slower and more difficult undertaking than the building of an entirely new station; and the satisfactory outcome reflects no little credit on Mr. W. S. Twining, M. Am. S. M. E., chief engineer of the company.

The outside walls of the building were not damaged to any great extent, and it was therefore determined to utilize these in the new construction, and it was also decided to make every part of the new building as nearly fireproof as possible, and to eliminate all features which would tend to reproduce the former disaster.

The original roof over the engine room was a single span of very light steel construction covered with thin wooden sheathing. The new roof is of unglazed terra cotta tiles resting on tee iron purlins and covered with slag on five-ply felt to prevent sweating.

As the walls were not considered heavy enough for this extra weight of roof a steel frame has been built in the engine room, which is now divided by the columns into a centre and two side aisles, the latter containing the generating units and being each about 40 feet in width.

In place of the single crane which formerly spanned the whole width of the engine room there are now two hand-power cranes, one in each side aisle; the crane girders resting on the steel columns entirely independent of the walls. To prevent the recurrence of a calamity similar to that which caused the destruction of the station, these cranes are worked from platforms running the length of the crane bridge on each side. These cranes have a capacity of 30 tons, and were built by Albert Box & Co., Philadelphia. This type of crane has been found very satisfactory in several of the stations of the same company.

The flooring consists of cast iron plates resting on steel beams, and gratings are generously distributed to supply light and ventilation for the basement. The exhaust from the engines is carried to a steel stack 7 feet in diameter and 130 feet high, at one end of the engine room, the stack being surrounded by a steel jacket, the annular flue between the stack and jacket providing a very efficient ventilating arrangement for the basement.

The main steam piping was formerly carried below the floor, rendering this part of the station excessively hot, but is now carried overhead, being supported on the steel framework of the building. A large monitor in the roof provides ample facilities for the escape of heat, and the room is very cool and comfortable. The roof over the boiler room is supported by two rows of built-up steel columns, similar to the construction of the engine room, and consists also of unglazed tile resting on tee iron purlins.

The boiler equipment consists of nineteen Babcock & Wilcox double deck water tube boilers, rated at 375 horse-power each. These were only slightly injured by the fire, the damage being confined chiefly to the destruction of the exposed parts and smaller fittings.

The coal and ash conveying machinery was destroyed, and at this writing has not been replaced. Owing to the location it is necessary to haul all coal to the station in carts, and it is now dumped directly in front of the boilers.

Two large steel stacks 11 feet in diameter and 170 feet high have replaced the induced draft apparatus and short stacks which were formerly used. This change has been made to remove as far as possible the complaints by residents in the immediate neighborhood on account of the dust and soot.

The former engine room equipment comprised a battery of five Kodac generating units of 500 horse-power each, and four horizontal Corliss sets, rated at 1500 horse-power each. The Kodac units, being next to the switchboard, were totally ruined by the fire, and have not been replaced; but instead two of the Corliss engines have been moved nearer the switchboard to take their place. No new engines have been installed, but the four Corliss engines have been rebuilt by the original makers, Robert Wetherill & Co., Chester, Pa., and with the increased steam pressure now develop 2000 horse-power each, running eighty revolutions per minute. They are running non-condensing, the same as formerly. These engines originally carried Westinghouse generators of 1100 kilowatts each, and for these have been substituted, as was contemplated previously to the fire, larger generators made by the same company and rated at 1500 kilowatts each. One peculiarity of these units is that the commutators face the fly wheels, being the reverse of the common practice; this brings the heavy weight of the armature core close to one of the main journals and the weight of the fly wheel close to the other, greatly reducing the bending moment on the shaft.

The new engine foundations which have been built are of stone instead of brick, and no cap stones are used, the engines being placed on heavy oil-tight cast iron sole plates. In the space vacated by the Corliss engines which were moved nearer the switchboard the boiler feed pumps and feed water heaters have been placed, the latter being Hoppes open heaters, arranged overhead. Space has also been reserved for the installation of an additional unit of the same size as those in use should the service demand it. A complete gravity oiling system has been installed, by which all lubricating oil is filtered and returned after use to overhead tanks for circulation through the bearings.

Every precaution is taken that the machines may be easily and safely handled. The main leads from the generators to the switchboard are carried in iron "Armorite" conduits, a separate conduit being provided for each cable. The equalizer switches are mounted on the wall near the machines, as has become standard practice of late, and the series field coils and equalizer are connected on the negative or ground side, which is the reverse of the customary practice. The old slate switchboard was totally ruined by the fire, and has been replaced by a mammoth white marble board, double deck, and running along one end wall of the engine room for its whole width, nearly 100 feet. The negative terminals of the machines have been isolated on panels entirely separated from the positive side. There are two positive bus bars running the whole length of both the upper and lower deck, one bar being connected to the positive machine panels, the other being connected through tie lines to the bus bars of the other stations of the system. By this means this large board is used as a distributing board, and serves as a sort of central exchange, it being possible to supply any or all of the 150 feeders on it with current direct from this station or from the other stations, as is deemed most advisable. These tie lines, as they are called, consist of heavy cables run underground between the switchboards of the various generating plants, and render it possible for one station to aid another in case of trouble. It also allows of shutting certain stations down at night or during periods of light load. The tie lines run to this station from five other power plants, one of them being of eight cables of 1,000,000 cm. cross section each.

The Apprentice Course of the Westinghouse Company.

The Westinghouse Electric and Manufacturing Company about two years ago introduced a system of training for their apprentices which has shown excellent results. Pupils are taken for three months on trial, and during that period are paid 5 cents per hour for their time. At the end of three months, if the pupil proves his fitness and character, he is regularly assigned to a place on the company's roll, and then for the remainder of the year he receives compensation at the rate of 8 cents per hour, with time and one-half for overtime. The second year the pay is 10 cents per hour, and for the third 12 cents, and the fourth year it is 15 cents per hour. Four years complete the course, which embraces mechanical drawing, the various branches of the machinist's and electrician's wood-working art, etc. The great advantages of such a course in such a complete establishment are quite evident. When the pupil is through, he receives $100 in addition to the regular compensation paid. He can then enter the service of the company as a regular employee, or he may go elsewhere. It is not surprising that there are more applicants for admission than the school can accommodate.

Additions to the Equipment of the Massachusetts Institute of Technology.

The collection of physical apparatus has recently been increased by a number of important additions. Among these should be mentioned particularly a large automatic mechanical air pump made by Ritchie. This has been supplied from the fund bequeathed to the institute by the late Mrs. Katharine Bigelow Lowell. It will be of much use in connection with the lectures on physics. Many new vacuum tubes have also been procured. The discovery of X-rays two years ago caused a lively interest in the study of the phenomena attending the passage of electricity through vacuum tubes. The institute had a very good collection of Crookes tubes, comprising all the ordinary forms, many of which were "used up" in early experiments in which they were over-driven by being used as the source of X-rays. Additions made during the past year have rendered the collection of vacuum tubes of all kinds exceptionally complete, probably the most so of any in the country. Beside the usual low-vacuum tubes and Crookes tubes in large variety, there are many novel forms illustrating peculiar phenomena and various new discoveries, including a number of original design and construction. Among low-vacuum tubes there may particularly be mentioned crown tubes for illustrating the phosphorescence of gases, the curious Holtz tube showing the influence of funnel-shaped apertures on the resistance, a series of Hittorf's "long-way tubes," showing how at a certain pressure the electrodes must be separated by a considerable distance in order that a discharge may pass directly between them; partition tubes for showing the existence of a great resistance against passage between a metal and a gas; a series of tubes at various exhaustions for clearly exhibiting the changed luminous phenomena due to change in pressure of the residual gas; a like set for showing particularly the change of gaseous resistance under like circumstances. An interesting set comprises the electrodeless tubes used by Prof. J. J. Thompson in his studies of the true resistance of gases. Various others illustrate the researches of Tesla, McFarland Moore and other investigators in the direction of utilizing the electric discharge as a means of illumination. A particularly beautiful series illusrates the effect of electric discharge in causing phosphorescence of minerals.

For the study of cathode rays, beside the ordinary Crookes tubes, there is the apparatus used by Lenard in his classical research, and the tubes of Goldstein showing the existence of several kinds of cathode rays wih diverse properties, also several tubes showing the remarkable repulsion phenomena observed by Goldstein. Others illustrate the curious change of colors of salts subjected to the action of cathode rays discovered by Goldstein and the capillary light recently studied by Schot. There is also a large collection of electrical and other radiometers illustrating the electrical and heat phenomena studied by Puluj.

The automatic mercury pump used in exhausting such tubes as are made at home is a very convenient form designed by Messrs. Norton and Lawrence, instructors in the institute, a description of which is soon to be published.

Reference should also be made to new apparatus for illustrating the phenomena of the Hertzian waves, and also the apparatus of Elster and Geitel for studying the effects of light and of the X-rays in causing the discharge of electrified bodies.

To the equipment of the laboratory of physical chemistry has been added apparatus for measuring the dielectric constant of substances by means of electric waves. The method, which is due to Professor Drude, of Leipzig, consists essentially in measuring the length of the electrical waves set up in a system of two parallel wires by a suitable spark exciter, first when the wires are in air, and second when surrounded by the liquid to be investigated. A vacuum (Geissler) tube placed in the path of the waves indicates by a sudden glow when a movable bridge placed across the wires reaches a so-called node. The apparatus has proved very satisfactory in the preliminary experiments of an investigation now being carried out in the laboratory.

A new quadrant electrometer of unique construction has also been received from Germany. The essential difference between this and other forms of this instrument consists in maintaining the vanes in the upper and lower quadrants at a constant difference of potential by means of a dry pile of many hundred films of lead peroxide, the pile itself forming a part of the suspended system. Quartz fibre suspensions are used, whereby a sensitiveness of less than a thousandth of a volt is obtainable. This, combined with the very small capacity of the instrument, renders it of great value for much electrometric work.

For the laboratory of heat measurements there has been purchased a Junker calorimeter for the determination of the heating value of gas. This is the newest and best device for this work, and makes it possible to determine the efficiency of gas for heating by means of stoves, or its value as a fuel for gas engines.

An extended investigation of the efficiency of non-conducting material used as a protection for steam pipes and boilers has been carried on in this laboratory by Mr. C. L. Norton for the last two years, and is nearing completion. This investigation, made at the suggestion of Mr. Edward Atkinson, is carried on by an entirely new method, the heat lost from a pipe being measured electrically. Greater accuracy than was possible by the older process is assured by this method.

The testing of cold storage insulation is being carried on in the same manner.

The equipment of the laboratory has been further increased by new apparatus for the measurement of the heat combustion of coal, and by a Callendar resistance pyrometer.

War Notes.

The following are some interesting notes concerning the electrical features of the Government's hasty preparation for war. They are taken from the daily press, and owing to the attempts of those concerned to avoid publicity they cannot always be verified. Those which can, however, will be so stated:

AN ELECTRIC PLANT AT THE PORT ROYAL STATION.

Twenty thousand dollars has been provided by an amendment to the Naval Appropriation bill for the installation of an electric light and power plant at the Port Royal station.

A TELEPHONE LINE OF STRATEGIC IMPORTANCE.

An amendment to the Naval Appropriation bill, providing $10,000 to be immediately available for repairing and improving the telephone line connecting the Navy Department, the Washington Navy Yard and the Naval Proving Ground at Indian Head, passed the Senate on April 21.

THE WESTERN UNION CABLE IN THE GOVERNMENT'S HANDS.

On Saturday, April 23, the United States Government seized the office in Key West of the cable owned by the Western Union Telegraph Company, running between that point and the coast of Florida. The reason given for this sudden move was the statement that the Government had found considerable difficulty in getting its business through on time.

BIDS FOR WIRE AND CABLE.

Bids were recently opened in the office of the Chief Signal Officer, Gen. A. W. Greely, Washington, for supplying the signal service with underground and aerial wires and cables. Bids were submitted by the Safety Insulated Wire & Cable Company, the Washburn & Moen Manufacturing Company, the Standard Underground Cable Company, the Okonite Company, and John A. Roebling's Sons Company.

TELEGRAPHY BY SEARCHLIGHT FLASHES.

It is stated that the powerful searchlight exhibited at the World's Fair and more recently purchased by the Government and set up at Sandy Hook, was recently tested to determine its availability for signaling over long distances. The light was directed at the dome in which the Weather Bureau office is situated in New York City, some 20 miles from Sandy Hook, and signals by the Morse code were read and repeated by wire.

TORPEDOES AND SHAD FISHERMEN.

Off Fort Wadsworth, in New York harbor, it has been found that shad fishermen whose nets were spread in the waters have not hesitated to cut the cables of mines and torpedoes planted there. The harbor is now patrolled every night and a strict watch is maintained by day. A threat has been made which is intended to carry terror to the heart of the fishermen. This is that the first man caught cutting cables will be arrested and the second will be shot on sight.

Electric Traction on the Chicago South Side Elevated.

On Saturday, April 23, a number of electric trains were successfully started in regular operation on the lines of the South Side Elevated Railroad in Chicago, which have been recently equipped for electric traction by means of the third-rail conductor and the multiple unit system. These trains were run between the regular steam trains, and more electric trains will be gradually put into service until the steam service is entirely replaced.

Hertz Wave Signalling in War.

BY CHARLES T. CHILD.

Among the various claims that have been more or less widely exploited for the system of electric wave telegraphy due to Mr. Marconi is one concerning its usefulness in war. At present the methods in use for communication by land forces comprise the telegraph, the telephone, the heliostat, flag signals, and, of course, the ancient method of messengers. Telegraphs and telephones requiring generally the installation of a wire cannot be always put in operation at the moment, and their signals are liable to be intercepted by the enemy or persons in communication with him. Flag and heliostat signals are visible to everybody in sight of the sending station, and messengers are liable to interception or delay in addition to being slow. On all these accounts the electric wave signal system, which will, of course, work in the dark when heliostats and flags are useless, has been highly commended by those who do not understand the principle of its working, as the ideal system for military use. Unfortunately these claims cannot be made good, for this apparatus has certain fatal limitations and weaknesses that render it practically of no value for this purpose.

The prime essential of a military signal system, of whatever kind, is reliability. Upon the certainty of its action operations of the most vital importance may depend. On this account the delicacy of the apparatus used, both in sending and receiving the wave signals, unfits it for field work, where it would inevitably receive rough treatment and become inoperative. Assuming that an army corps equipped itself with instruments of this character, let us see what would have to be carried along.

At each station the apparatus would consist of an induction coil of very large size, an appropriate battery for working it, or a small dynamo and its motive power, a "coherer," a captive balloon or kites, and the usual telegraph relays and sounders with their local battery. This outfit would require for its transportation several wagons and a corps of a dozen or more men. It would be absolutely necessary to carry along some form of gas-making machine for the balloon, for a balloon is the only means of surely and certainly establishing the upper terminal of the inducing and receiving lines at the required great height. Some form of waterproof protection for the instruments would also be necessary, while the batteries could probably be carried empty, their fluids in proper receptacles. If a dynamo and engine is carried the whole outfit would have to be kept dry, and this means probably its installation in some sort of covered vehicle.

Suppose now that it is desired to communicate with a base. The balloon is unpacked, the gas machine put to work, and it is inflated. Meanwhile the batteries are mounted and the instruments put into such adjustment as is possible. The balloon is sent up, and after further adjustments communication is established. If there is a thunder storm anywhere in the vicinity (and field operations are usually conducted in the summer) the trouble begins at once. Even if there is no thunder storm the atmospheric discharges along the vertical conductor conflict with the messages, while the appearance of the balloon advertises the precise location of the signal corps to the whole surrounding neighborhood.

The range of such an apparatus as this, in fine weather and with all the conditions favorable, is about 20 miles, possibly more. This distance could be covered, in any country possessing decent roads, in two hours by a messenger on a horse or bicycle. A field telegraph line could be strung in three hours. A heliostat could be set to work, if the conditions were favorable, in ten minutes, while two men could pack it up and carry it away in as many more if necessary. To move the wave apparatus would involve hauling down and deflating the balloon, though it has been seriously proposed to move army balloons attached to wagons, while they are in the air. On the plains this might be feasible, but in a country where trees grow at the roadsides it would be absolutely impossible.

It must not be forgotten that the picking up of a wave signal necessitates the existence of all the paraphernalia described above in working condition. With its balloon down and apparatus packed up a corps depending on this kind of signal would have no communication. As it is impossible to move it and maintain its adjustment, and since armies are often moving, this means that it would be out of service just when it is most needed. It seems from these few considerations that the ether wave telegraph is certainly not yet ready for service as a military auxiliary.

In this connection the usefulness of another sort of signal should not be forgotten—the searchlight. A boiler, engine, dynamo and searchlight of considerable power can be mounted somewhat after the fashion of a steam fire engine, so as to be easily within the pulling capacity of four horses. At night, when there is no occasion to conceal the signals, flashes from such a light can be read at a very great distance; while by day its directed beam is invisible, save at some point in its length, and could be used in place of the heliostat in cloudy weather.

The Power Plant of the Trans-Mississippi and International Exposition.

The architectural beauty of the buildings about the Grand Court of the Trans-Mississippi and International Exposition, which are similar to the structures surrounding the Court of Honor at the World's Fair, forbids the installation of any steam generating machinery in this immediate neighborhood. It has, therefore, been decided to operate all exhibits in motion in this part of the grounds by electric power developed at a distance. The power plant is, therefore, strictly a service plant designed to supply power for the actual requirements of the exposition, although its parts will, of course, be arranged as exhibits in operation.

The power house is 170 x 120 feet in size and is located at the northern end of the Bluff Tract, sufficiently removed from the Grand Court to avoid any marring of the classic beauty of that part of the grounds, yet near enough to give good service with a reasonable expenditure for copper. The foundations are built as though for a permanent plant. The boilers, six in number, four of 600 horse-power and two of 300 horse-power, are of the Morrin Climax type, built by the Clonbrock Steam Boiler Company, Brooklyn, N. Y. The steam pipes are so arranged that one-half of the boilers may be run at one pressure and the other half at another, all pipes and fittings being extra heavy to avoid any risk of their giving way. The boiler house is to be fitted complete with automatic steam pressure recorders, high and low-water alarms and all the latest auxiliary devices in this line.

The dynamo and engine room is a large, well-lighted structure, the roof trusses being sufficiently strong to be used for swinging the heavy machinery into place. The current is supplied entirely from generators furnished by the General Electric Company, which are set up in groups as follows: Four 120-kw and two 180-kw alternators; six exciters, four 125-light Brush arc machines, one 266-kw direct-current 500-volt machine, beside several special generators for searchlight and projector service. These generators are driven by three 18 and 30 x 16 Westinghouse compound engines, one 16 x 16 engine supplied by the Buffalo Forge Company, one 16 x 16 Imperial engine and one 24 x 48 Sioux engine.

The switchboards are built up of the General Electric Company's standard marble panels, all the special decorative lighting being directly controlled from the board. A gallery for the use of visitors is mounted between the boiler and engine room. Exhaust steam is carried underground to a distance from the building.

The work is sufficiently far along to justify an assurance of completion on the opening day, a desirable feature rarely attained in large expositions.

Magnets Without Magnetism.

What becomes of the internal lines of force of permanent bar magnets when there is no opportunity for the lines to complete a magnetic circuit, is a rather interesting problem, although of no practical value. Such a condition can be imagined by conceiving a hollow sphere made up of truncated pyramidal bar magnets, their north poles all aiming toward the centre and their south poles aiming radially outward and mutually fitting each other to make a mass of steel of the shape mentioned. If any opening is left between the internal hollow of the sphere and the exterior space, some lines, of course, will return through this opening, but provided the hollow shell is made up of perfectly fitting magnets, all of the same M. M. F., there is no opportunity for the lines of any one to close upon themselves. It would seem as though such a sphere would exhiit no magnetic effect on its outer surface, although the perfectly analogous case of a sheet or wall of finite thickness, but infinite length and breadth, made up of permanent bar magnets, their south poles all on one side of the wall and their north poles on the other, would appear to give a polarity on either side. Obviously the lines of force in this case have no better opportunity of completing a magnetic circuit than in the former case.

Some Early Electric Railways.

To the Editor of The Electrical World:

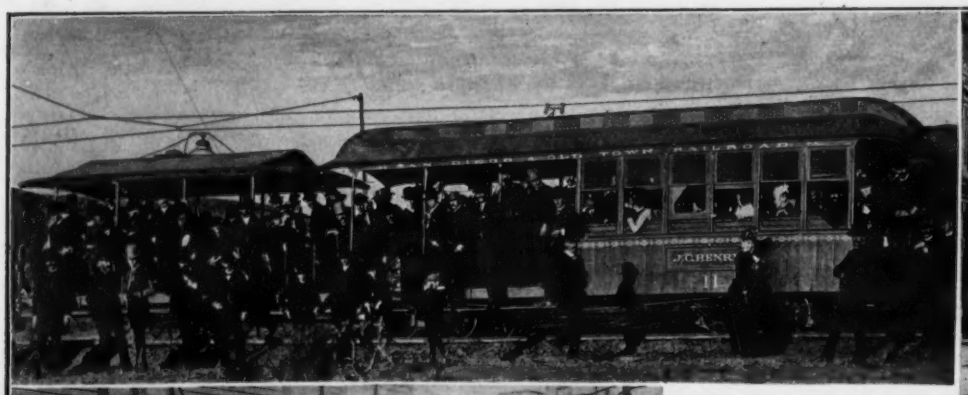
Sir:—In view of the fact that there has been considerable history manufactured in regard to the first electric roads, and to combat an official statement made by the Acting Commissioner of Patents in his last annual report that the first commercial electric road was built but ten years ago (presumably the Sprague Road at Richmond) I send some heretofore unpublished views of historical interest showing my personal efforts in that direction.

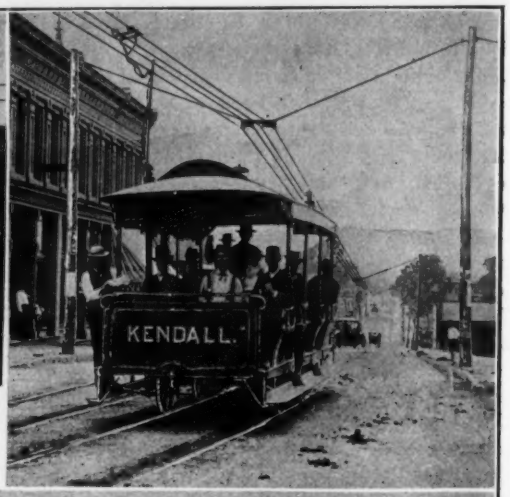
Views 1 and 2 were taken from the East Fifth Street Road in Kansas City in the fall of 1886. Fig. 3 represents one of the trains on the San Diego and Old Town Road in California, taken in the summer of 1887. Fig. 4 represents a view on the Fourth Street Road in San Diego, which was constructed in 1887. On the latter road, which was about 5 miles long, we carried as high as 150 passengers up a 9 per cent. grade with a single motor. On the Kansas City Road we used the double overhead structure. On the Old Town Road in San Diego we used underground feeders with single overhead wires. All of those roads were supplied from compound wound dynamos. The motor fields were wound with a multiplicity of parallel wires. The motors' resistance was varied with a switch which connected more or less of them together in parallel. The armature ran constantly and was connected to or from the car by a combined differential gear and clutch running in oil. The diminutive trolley engaged the sides and bottom of the trolley wire, the wheels, which ran in a horizontal position, being held to the wire by strong springs. These wheels, which were 3 inches in diameter, were made of steel tempered "file hard." By using this form of trolley we were enabled to keep up a traveling contact with the trolley wire, which in some cases was 15 feet to one side of the track.

The details of the line construction and the motors were worked out, and tested by the writer during the years 1884 and 1885 on the Westport Road, and also on the Fort Scott & Gulf Road in the suburbs of Kansas City.

John C. Henry.

Denver, Col.





SOME PIONEER ELECTRIC RAILROADS.

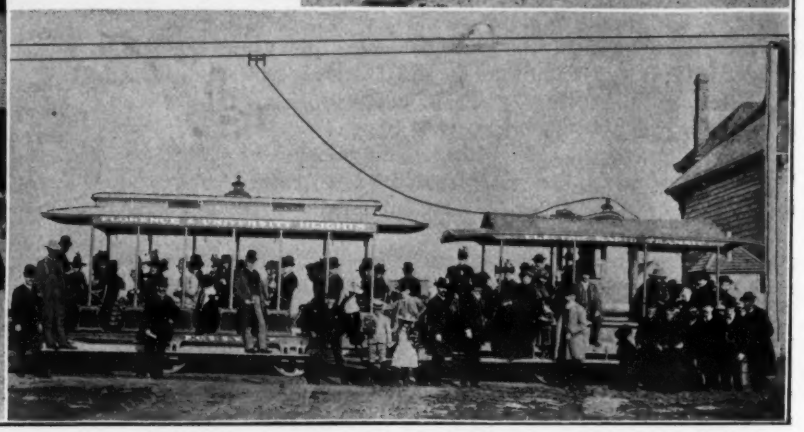


Fig. 3.

Fig. 2.

Fig. 1.

Fig. 4.

Lowering Transformers for Niagara Power.

To the Editor of The Electrical World:

Sir:—In your issue of April 9 appeared a very interesting article by Mr. J. S. Peck, on some Westinghouse transformers for the Niagara Power plant. On page 437 a supposed new mode of regulation is described, which consists of varying the pressure on a circuit by a third coil on the transformer, and further in using a reversing switch in connection with a transformer winding. It may be of interest to know that either mode has been described and patented in 1890. In patent 423,553, "Alternating Current Electric Regulator," one of the claims reads as follows: The combination in an electric converter, of a sub-division coil, and pole changers connected in circuit with sub-divisions of said coil. In patent 431,460 of the same year a claim reads: In a system of alternating current distribution, the combination of an electric converter, a core, a primary coil, and a secondary coil for the converter, translating devices in circuit with the secondary coil of the converter, an additional coil mounted on the converter's core, independent of the converter coils, and means, such as a switch, for including said additional coil in circuit with one of the converter's coils. These and other claims seem to fully cover the ground, at least the novel part.

Ludwig Gutmann.

Peoria, Ill.

[The writer of the above letter seems to have mistaken the application of the claims to novelty in the original article. The features spoken of as new and described by Mr. Peck appear to be the means of obtaining a balanced regulation on the three sides of a three-phase circuit with only two regulating coils, and the means described for avoiding the difficult manipulation of either the high voltage primary current or the large volume secondary current in the regulator and reversing switch, by means of an intermediate voltage obtained by a special transformation and a further transformation after regulation by the use of series transformers in the secondary lines.—The Editor.]

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering.

Dynamos, Motors and Transformers.

COMMUTATION OF CONTINUOUS CURRENT DYNAMOS. Sayres. Lond. "Elec.," April 8.—A brief reply to the criticism of Housman (see "Digest," March 26); he believes that the views of Housman are not correct for any practical armature.

ALTERNATING CURRENT MOTORS. Tasker. Lond. "Elec. Eng," April 8.—The conclusion of his paper (see "Digest," last week).

DESIGN OF SLOW-SPEED MOTORS. Dunn. "Elec. Eng.," April 7.—In this continuation of his serial (see "Digest," April 9) he discusses the winding of the armatures, which becomes difficult on account of the large amount of copper. The series is concluded in the issue of April 21. He discusses briefly the relative advantages of slow and high speed motors. Experience has shown that the cost of the direct-connected slow-speed motor, when the attachments can be made at the place of manufacture, is not much different from that of the high-speed if the belts and pulleys are included with the latter; for 100 to 250 revolutions per minute, as for printing presses, the efficiency is about equal; below this it favors the high-speed motor and above the direct motor. Curves are given, showing the efficiency as affected by the speed, and another showing the efficiency of the high-speed motor with the speed-reducing mechanism.

MOTORS IN A PRESSROOM.—"West. Elec.," April 16.—An illustrated description of the application of electric motors in the pressroom of a Chicago daily paper. The most important feature of the plant is said to be the electro-pneumatic system of motor control which is described.

MAGNET WINDING. Baxter. "Amer. Mach.," March 31 and April 14.—Descriptive articles of a practical and somewhat elementary character, on the determination of the size and number of turns of wire, the former for a constant speed motor and the latter for a constant potential generator; the latter is merely introductory in character and is quite elementary.

Lights and Lighting.

ARC LAMP SYSTEM.—"Zeit. f. Beleucht.," March 30.—An illustrated description of the Hegner system, in which several arc lamps are run in series and have a single regulator. When arc lamps are run from constant potential circuits considerable energy is lost in the resistances which must be placed in series with each of them; in the present system there is only one such resistance for a group of lamps. Besides the single dead resistance there is a relay connected parallel to a group of say three lamps, and this coil takes the place of the fine wire coil in the lamp, and there is therefore only one of these for the three lamps, for which reason the three lamps will act, as far as differences of potential are concerned, like a single lamp.

HOISTING GEAR FOR STREET LAMPS.—Lond. "Elec. Rev.," April 8.—An illustration of a device in which the hoisting cord passes through the mast and through a semicircular arm on the end of which the lamp hangs.

INCANDESCENT GAS AND ELECTRIC LIGHT. Maxon. "Prog. Age," April 1.—A reprint of a paper read before the Ohio Gas Association on the competition between incandescent gas and electric lights. It favors the former.

EXPERIMENTS WITH INCANDESCENT LAMPS. Maxim. "Sc. Am. Sup.," April 16.—A reprint of the short article noticed in the "Digest," February 5.

Power.

ELECTRIC CRANES. Statter. Lond. "Elec. Eng.," April 8.—A long abstract of a paper read before the Northern Society of Electrical Engineers. It refers chiefly to the question of motors and the gearing. It appears that the most satisfactory results are obtained with a separate motor for each movement, using worm gear for the reduction; a single motor with clutch gearing does not start so steadily with a rapid acceleration. He then describes a third type which he believes to be new; it has one motor for each movement, and is run either with a constant E. M. F. or a constant current, but the former he claims has little commercial value; the regulation is obtained by a relative movement between the armature and field by the rotation of the one or the other, and is said to be the equivalent of two motors with their armatures arranged in series, each being capable of absorbing the full E. M. F.; by stopping one of the armatures with a break the other one will increase its speed; there appears to be difficulties in reversing; the efficiency is poor and therefore the commercial applications are not likely to be extensive. He believes, however, that they are practical when fed by a constant current; one form of such crane has been in successful operation for a year; there was no trouble with sparking; there are three directly geared motors, which are started and stopped and reversed, the control being effected by altering the position of the brushes on the commutator; short circuiting the armature is a sufficient break. (The description is not quite clear.)

ELECTRICITY ON BOARD SHIP. Tidd. Lond. "Elec. Eng.," April 8.—The beginning of a reprint of a paper giving a number of illustrations of direct connected units for this purpose. Electricity is now a necessary part of a ship's equipment, and can no longer be considered a fad; he urges marine engineers to obtain some knowledge of electrical matters; he believes that soon electric wires will replace all the steam pipes on the deck for the use of winches, etc.; passenger boats, when not too small, should have at least two sets of plants, each equal to about two-thirds of the entire capacity, so as to act as reserve; he recommends as the best position for the plant the place over the thrust recess, about on a level with the middle platform; unless absolutely impossible the shaft should always be placed fore and aft; he also prefers placing the engine shaft aft and the dynamo forward, as the oil is then not splashed so much over the dynamo; direct coupled plants are almost universally used, and no other kind should be passed; he prefers the enclosed type of engine.

MECHANICAL APPLICATIONS OF ELECTRICITY. Richard. "L'Eclairage Elec.," April 2.—Brief, illustrated descriptions of various applications taken from patent specifications.

STORING POWER OF LIQUID AIR.—"Eng. News," April 14.—In a short editorial article on liquid air some comparisons are made. Calculations show that the work done by 1 cubic foot of liquid air is one horse-power for three hours and fifty-three minutes, in which the heat supplied and friction losses are not considered; this is equivalent to 139,100 foot pounds or 4.25 hp minutes stored per ton of liquid air; a pound of storage battery stores from 8500 to 15,000 foot pounds, or from one-tenth to one-twentieth of that in liquid air; a pound of water stored under 400 pounds pressure, and at a temperature of 445°, stores 43,000 foot pounds, or about one-quarter that of liquid air. The figures are meant to represent the possibilities of liquid air rather than what is now attainable.

PIONEER TRANSMISSION PLANT.—"Jour. of Elec.," March.—A long illustrated description of this plant, which is to utilize the water power of the Ogden canyon, in Utah, for irrigation and other purposes; ultimately the entire flow of the river will be utilized. The description refers chiefly to the civil engineering features. The electric generators consist of five three-phase alternators, each of 750 kilowatts; the frequency is 60, the voltage 2300, which is transformed up to 16,1000 for the line, one circuit of which, to Salt Lake City, covers a distance of 36.5 miles.

DELTA. Stubbs. "Eng. News," April 21.—A short, illustrated description of a small water power transmission plant in York County, Pennsylvania; it is claimed to be a type of what can be done in many places. The power is used chiefly for replacing steam in the mining and working of slate. The fall is 42 feet; the town of Delta is 5.5 miles distant; a two-phase generator of 350 kilowatts generates at 5600 volts, at which it is transmitted over four bare wires on porcelain insulators, with a loss of 10 per cent.; the voltage is reduced to 450 for the motors and to 1000 for the lighting system; the charge is $25 hp year of ten-hour days.

COST OF ELECTRIC POWER. Elliott. "Can. Elec. News," April. —An author's abstract of a paper in which he discusses the various items that enter into the cost of production of power for lighting and the effect on the cost per unit, of different styles of engines, kinds of coal and methods of supply. The chief factor which influences the cost is said to be the variable load.

Traction.

MAGNETIC BRAKE. Kubierschky. "Elek. Zeit., April 7.—A well illustrated description, with detail drawings, of the electro-magnetic brake devised by him and of which thirty-six have been used for a number of years on the Dresden line. The object of these brakes is to relieve the motorman of the power which he is required to exercise with mechanical brakes, and to enable them to be applied to trailers. The current for the brake is obtained from the motors while the car is being brought to rest, as distinguished from being taken from the line. Some tests made several years ago with a car weighing 7000 kg showed that with a velocity of twenty-four km per hour it was brought to rest in a distance of 11.5 meters on a level track. The brake is of a comparatively simple construction, is placed on the axle, and consists in general of two parts, one of which rotates with the shaft, while the other is stationary and contains the electro-magnets; the former consists of a round disc which revolves in front of the poles of the four magnets, acting as an armature to them; the disc is so mounted that it admits of a slight motion in the direction of the axis. Experience has shown that the wear of the surfaces is not more than 1 to 2 mm. per year, and that therefore the cost of maintenance is not nearly as great as with the ordinary mechanical brake.

TRACTION ACCUMULATORS. Niblett. Lond. "Elec. Rev.," April 8.—The beginning of a reprint of a paper in which he describes recent improvements in such batteries and shows how accumulators are best used for this work. The paper is of an elementary character and is written in a somewhat popular style. It is being reprinted in "El'ty" (N. Y.), beginning with April 20.

CENTRAL LONDON RAILWAY.—Lond. "Engineering," April 8.—Illustrations, with a brief description of some of the machinery of the contractor's plant; electricity is used largely for driving the various appliances in the construction of this underground road.

INCLINED RAILWAY IN HAVRE.—"L'Eclairage Elec.," March 26.—A brief description of this line, 750 metres long, the construction of which involved many difficulties.

POWER STATION EXPEDIENTS. De Gruchy. "St. Ry. Rev.," April 15.—Illustrated descriptions of some practical power station devices. One is a quick and simple device to set back the brushes of a dynamo when there is a short circuit on the feeder which has caused the breaker to open the circuit; to do this by hand requires considerable time; the device is an application of the eccentric, and is operated by a lever working all the brushes at once. Another device is described by which any number of circuit breakers can be connected with a bell, so as to ring an alarm when one is opened. A diagrammatic description of the Thomson arc lamp is also given.

PATTON MOTOR CAR.—"Eng. News," April 14.—A note stating that in a recent test a run of 279 miles was made in sixteen hours, with a consumption of fifty-eight gallons of gasoline. As was already described, this car contains a gas engine, dynamo and storage battery.

EFFECT OF WAR ON STREET RAILWAYS.—"St. Ry. Rev.," April 15.—Opinions of a number of leading presidents and operators of street railways on this question.

POLES.—"St. Ry. Rev.," April 15.—An illustrated article on poles used for trolley lines.

Installations, Systems and Appliances.

COST OF GENERATING AND DISTRIBUTING ELECTRICAL ENERGY. Hammond. Lond. "Elec.," April 8.—In this continuation of the long abstract of his paper (see "Digest," last week) he discusses the reliability of the plant. He believes that in some cases the pursuit after efficiency has resulted in a sacrifice of the reliability; he always insists on rigid and prolonged tests after the completion of the plant, including a ten or twelve hours' consecutive running at full load, and two hours at emergency load; also the governing effect when the whole load is suddenly thrown off or on, and the limit of temperature after the running. The importance of a good engineer is pointed out; the efficiency of the generating plant is discussed, including a table of results which he obtained. He then discusses the efficiency of distribution and the all-around efficiency, in which he shows that the coal bill could not be obtained. a criterion, as coal may be cheaper in one station than in another, or it may be of different quality; a correct comparison could be made by a reduction to thermal units. Some results for stations where similar coal is used are given, as also a diagram showing the relation of coal consumption per unit to the units sold, for fifty-two different stations. An abstract is also continued in the Lond. "Elec. Rev.," April 8, and some extracts are given in "El'ty" (N. Y.), April 20.

ELECTRICITY SUPPLY. Gibbings. Lond. "Elec.," April 8.—The first part of a series of articles in which he will consider what has been attempted and accomplished in the methods to give the consumer greater advantages, helping to reduce the bill, and he will point out those instances in which a particular apparatus or a special method of charging have been found successful or otherwise; he deals chiefly with the methods of widening the daily peak, and with the more extended use of electrical energy for other purposes than light. The title of the series is the "Commercial and Business Aspects of Municipal Electricity Supply"; the present portion refers to the position of the electricity department in relation to other municipal departments.

DOUBLE RATE METERING. Voigt. "Elek. Anz.," April 3.—A communication in which he makes some suggestions. Instead of two meters, a meter and a registering apparatus might be connected in series; from this the amount of energy sold at the cheap rate can then be calculated. Another is to provide the consumer with a switch by means of which the meter may be made to operate for the lower rate, but so arranged that if more than a few lamps are then used the meter will automatically insert a resistance in the circuit which reduces the light and compels him to switch over to the lighting circuit again.

CHARGING SYSTEM AT BRIGHTON.—Lond. "Elec. Eng.," April 8.—A report by Wright to the city authorities, recommending a further reduction in price after the first hour's average daily use from 3 to 2 cents; the suggestion was adopted. A long list of stations is given where the well-known Wright system of charging is used.

CENTRAL STATION ACCOUNTS.—Lond. "Elec.," April 8.—An analysis of the accounts of a municipal station at Hanley and of the work at Leeds.

CENTRAL STATIONS. "Eng. News," April 14.—A note giving some statistics from the "American Electrical Directory." The number of stations in the United States is now 2594, of which 2261 are owned by private parties and 333 are municipal plants; the former represent an investment of $230,000,000, and include 264,428 arc lamps and 7,234,134 incandescent lamps, requiring 970,481 horse-power of engine power. The municipal plants include 26,087 arc lamps, 371,444 incandescent lamps, and require 67,740 horse-power. Another note in the same journal names the cities in Germany which own their own works, as also those in which there exists the right of purchase.

Wires, Wiring and Conduits.

NEW METHOD OF BREAKING CIRCUITS. Janet. "Bul. Soc. Int. des Elec.," March.—The complete paper, of which an extract was published in The Electrical World, April 2, p. 411. The paper is quite long, and contains nineteen illustrations.

AIR CIRCULATION CABLES. Barbarat. "Bul. Soc. Int. des Elec.," March.—The complete paper, an abstract of which was noticed in the "Digest," April 9.

ARMORED CABLES.—Lond. "Elec. Eng.," April 8.—Answers to a request for reasons for and against laying armored cables directly in the earth.

PROPERTIES OF HIGH POTENTIAL INSULATORS. Bell. "Jour. of Elty," March.—A short article in defense of porcelain insulators, which he claims are now quite able to withstand the strains; he does not approve of the multiglaze types, on the ground that there are many more chances for trouble, owing to the multiplication of the layers of glass.

Electro-Physics and Magnetism.

UNIPOLAR INDUCTION. Andriessen. "Elek. Anz.," April 3.—The law of Maxwell, namely, that the current (strictly speaking the E.M.F.) is caused by the increase or decrease of the lines of force in a loop, does not apply to unipolar induction machines; if, for instance, a conductor is rotated around a magnet so that one end touches one of the poles and the other a point in the middle between the poles the conductor will in every position always embrace the same number of lines of forces, but a current will nevertheless be produced. In the present short article he shows that both kinds of induction can be included under the same law. He assumes that a moving charge is equivalent to a current, and therefore also generates a magnetic field, from which it follows that a magnetic field will set a charge into motion, although this has not yet been proved experimentally because the force is so small. A conductor which moves through magnetic fields has charges developed in it, and if these charges can equalize themselves a current results; in this way unipolar induction can be explained. (Some years ago the compiler explained this apparent discrepancy by stating that the sliding contact may be considered as the equivalent of an elastic wire which was being coiled on the revolving shaft, thus the moving loop will cut the same field repeatedly, thereby increasing continually the number of lines of force enclosed by it; after a few revolutions for instances the lines of force would be enclosed in a coil to which one turn is being added at every revolution.)

NODULAR CATHODE RAYS. Wiedemann and Wehnelt. "Wied. Ann.," No. 3; abstracted in the Lond. "Elec.," April 8.—They studied the deformations of cathode rays when in the direction of the magnetic field as distinguished from across it; the results are completely explained by the projected particle theory. The rays curve inward and then out again, making a succession of nodes, which bear a resemblance to those of a vibrating string (but the distance between the nodes increases with the distance from the magnet). A test was made to see whether the glow light was similarly affected, but it did not show the same characteristic appearances.

ELECTRIC DISCHARGES IN A MAGNETIC FIELD. Broca. "L'Eclairage Elec.," April 2.—A reprint of an Academy paper on some properties of electric discharges produced in a magnetic field.

DISCHARGES FROM URANINITE. Villari. "L'Eclairage Elec.," April 2.—An abstract from an Italian paper, describing the properties of discharges produced in gas by the mineral uraninite.

COLORATION OF HALOIDS BY CATHODE RAYS. Wiedemann and Schmidt. Wied. Ann.," January; abstracted in "L'Eclairage Elec.," April 2.—Descriptions of experiments.

CANAL RAYS. Wiedemann and Schmidt. "Wied. Ann.," 62, page 468; abstracted, with some illustrations, in "L'Eclairage Elec.," March 26.—They show the influence of Canal rays on the electric properties of discharge tubes.

VISIBILITY OF RÖNTGEN RAYS. Dorn. "Wied. Ann.," No. 3; noticed briefly in the Lond. "Elec.," April 8.—He shows that the light effect is not due to the act of accommodation; this was proved by paralyzing the accommodation capacity of an eye and then looking for the Röntgen light which was seen just as well as before. It is also shown that the effect was not due to the electric discharges in the neighborhood of the head.

ELECTRIC FIELD OF GEISSLER TUBES. Graham. "Wied. Ann.," January; abstracted in "L'Eclairage Elec.," April 2.—Descriptions of some experiments using currents from a high voltage battery.

ACOUSTIC COHERERS. Auerbach. "Wied. Ann.," No. 3; abstracted briefly in the Lond. "Elec.," April 8.—He showed that metallic coherers diminish in resistance not only by electric but also by the impact of sound waves; small, hard steel balls such as are used for bearings diminish in resistance down to 0.8 per cent. by acoustic influence, and 2.2 per cent. by electric waves. Whether

the electric impulses work in a similar mechanical manner is a matter for further investigation. In wireless telegraphy coherers should therefore be shielded from sound waves.

CONDUCTIVITIES OF IRON. Schulze. "Wied. Ann.," No. 63, page 23; noticed briefly in "L'Eclairage Elec.," April 2.—He compared the heat and electric conductivities of iron, which did not follow the law of Wiedemann and Franz, and found that the conductivities of different samples varied very greatly.

ENERGY OF AN ELECTRIFIED SYSTEM. Pellat and Sacerdote. "L'Eclairage Elec.," April 2.—A short Academy paper of a theoretical nature.

IMAGINARY QUANTITIES. Pomey. "L'Eclairage Elec.," April 2.—A short article on the application of imaginary quantities to the graphical representation of currents in a theoretical transformer.

MAXWELL'S THEORY OF LIGHT. Edser. Lond. "Elec.," April 8.—A short abstract of a Royal Society paper on an extension of Maxwell's electro-magnetic theory of light to include dispersion, metallic reflection and allied phenomena.

SPECIFIC INDUCTION AND INDEX OF REFRACTION. Koch. "Wied. Ann.," 63, page 132; noticed briefly in "L'Eclairage Elec.," April 2.—Descriptions of some experiments with liquids and gases in a magnetic field.

ELECTRICAL HYPOTHESIS OF THE SOLAR SYSTEM. Delta. Lond. "Elec. Rev.," March 4, April 1 and 8.—In this conclusion of his long article he discusses various observations concerning atmospheric electricity, etc.

ELECTRO-MAGNETIC SCREENING. Maurain. "L'Eclairage Elec.," April 2.—Induced currents in a conductor tend to reduce the action in the interior of the conductor; after referring briefly to the experimental investigations of Hughes and of Smith, he describes those made by himself at the usual frequencies of alternating currents. He used screens of hollow cylinders and measured the electro-magnetic action at the centre, the inducing current being around the outside; deflections in an electro-dynamometer showed the strengths of field in the interior; the ratio desired was equal to the square root of the quotient of the two deflections without and with the screen; he used only non-magnetic materials for the screens. The results are given in curves, showing the relation between this ratio and the frequency. He then compared these with the theory and found agreement; the results showed in most cases that the action can be calculated in a simpler way than by the usual complicated formula.

THEORIES OF FERRO-MAGNETISM. Fleming. Lond. "Elec.," April 8.—An editorial reference to his theories, which were explained in a recent lecture; they appear to be the same as those referred to in the "Digest," November 13, 27 and December 4. It is no explanation to attribute the same properties to the atom or molecules as are found in large masses, and this theory, therefore, endeavors to explain the existence of magnetism in the molecules themselves. Editorially it is thought to be the most rational and consistent hypothesis that has yet been advanced, and it is endorsed by that journal. He attributes the properties of iron and some other elements "to the circumstances of the gyrations of the ferro-magnetic molecules occurring around such axes as enable only one of the two kinds of electrification in the molecule to rotate around the axis, the other electrification being actually on the axis;" thus an effective displacement current is caused to circulate in the space occupied by the molecule, and it is equivalent to an ordinary current flowing through the perfectly conducting molecule itself; ferro-magnetism is therefore an accident of molecular constitution, but the opposite condition of diamagnetism pertains to individual atoms. A short abstract is also given in the Lond. "Elec. Rev."

RELATION BETWEEN TORSION AND MAGNETISM. Drude. "Wied. Ann.," 62, page 9; abstracted in "L'Eclairage Elec.," April 2.

ELECTROMAGNET FOR THE USE OF OCULISTS. Jones. "Jour. of El'ty," March.—A short, illustrated description of a magnet which he constructed and which is about double the strength of the one made for this purpose by Habb, of Zurich; the strength of the magnet is not given; it is a straight electromagnet, with the cores ending in points.

TEMPERATURE COEFFICIENTS OF MAGNETS. Ashworth. "El'ty," April 20.—A reprint of the short article noticed in the "Digest," April 16.

Electro-Chemistry and Batteries.

MANUFACTURE OF PHOSPHORUS.—"L'Eclairage Elec.," March 26.—Brief mentions of several patented processes. That of Gin and Leleux consists in heating in an electric furnace a mixture of the phosphate of calcium and coke, finely pulverized and well mixed: when it is melted all but one opening of the furnace are closed, and through this the phosphorus is distilled. In the process of Boublique phosphide of iron is decomposed electrolytically, and the phosphorus which is set free is surrounded by an inert gas. Collardeau uses a mixture of the carbide and the phosphide of calcium in an electric furnace, containing 310 parts of the phosphide of calcium, 260 of "live chalk" and 160 of coke, when nearly all the phosphorus will become phosphide of calcium; the hydrogen phosphide obtained from this is led into a tube lined with coke and heated to a red heat, which decomposes it into hydrogen and phosphorus. He also treats phosphide of calcium in the electric furnace with phosphate of chalk and silica, forming a silicate of chalk and setting phosphorus free.

SEPARATION OF SILVER. Kuester and Von Steinwehr. "Zeit. f. Elektrochemie," April 5.—They discuss the question of the electrolytic deposit of silver from the nitrate solution for analyses, and the separation of silver from copper. As the silver is frequently obtained in the form of a spongy mass, which is not adherent, they investigated the subject so as to determine the conditions under which reliable results can be obtained; the paper deals with their investigations. The error in the usual prescription is that it is required to keep the current density constant, while really it is the voltage which should be kept constant; they found that the beginning of the formation of spongy silver always corresponded to the same voltage, while the current strength could be varied between wide limits. Good results will be obtained if the solution is heated to about 55 to 60° C. and contains 1 to 2 cb. cm. nitric acid of 1.4 (presumably per liter) and 5 cb. cm. alcohol; the voltage should be kept constant at 1.35 to 1.38. If a resistance is placed in circuit the voltage must be kept constant by varying this resistance, which is very tedious, and they therefore prefer starting with the proper voltage and using no resistance.

ELECTROLYTIC HYDROGEN AND OXYGEN. Hammerschmidt and Hess. "Chem. Zeitung," 22, page 123; abstracted briefly in the "Zeit. f. Elektrochemie," April 5.—Oxygen is obtained commercially at Hanau, Germany, from sodium hydrate at 60° C; to obtain 100 cb. m. of oxygen and 200 of hydrogen per twenty-four hours requires 60 kilowatts; the cost of the installation was $21,150 and the daily cost of operation, including interest, amortization and repairs, etc., was $32.5. Even when it is desired to make hydrogen alone the electrolytic method is commercial, as the cost, including interest on the plant, is $0.16 to $0.20 per cb. m., while the cost for the chemical generation would be $0.53.

CURRENTS IN MIXTURES OF ELECTROLYTES. Hopfgartner. "Zeit. f. Elektrochemie," April 5.—Results of researches with a number of mixtures, each of two electrolytes, in which he determined the amount of kations which were transferred to the cathode during that electrolysis, the object being to test a certain formula. He found that Schrader's formula for the division of the current between the two electrolytes is applicable to much higher concentrations than were assumed by Schrader.

CURRENT FOR ELECTRO-PLATING.—Lond. "Elec. Rev.," April 8.—A few illustrated descriptions of methods showing how to obtain low voltage plating currents from lighting circuits, but it appears to contain nothing new.

ELECTROLYTIC ANALYSIS. Arth. "L'Eclairage Elec.," April 2.—Descriptions of some methods for analyzing certain alloys.

POLARIZATION THEORY. Oberbeck. "Wied. Ann.," 63, page 28; noticed briefly in "L'Eclairage Elec.," April 2.

RELATIONS BETWEEN CHEMICAL AND ELECTRICAL ENERGY. Klaudy. "Zeit. fuer Elek.," March 27 and April 3.—The concluding parts of his series of mathematical articles.

THEORY OF REVERSIBLE CELLS. Darrieus. "L'Eclairage Elec.," March 26.—The continuation, and apparently the conclusion, of his series of articles. He concludes that the name "accumulator" is not a proper one; among the "reversible cells" the lead couple is a simple primary battery, consisting of lead in an allotropic state and a depolarizer, peroxide of lead; the action in a lead battery is said to be explained without any mystery and without the need of any questionable hypothesis.

CALCIUM CARBIDE PLANT. Temple. "Eng. News," April 14.—A well illustrated description of the plant near Lynchburg, Va., which takes the place of the experimental one at Spray, N. C. The output will be 10 tons per day, allowing 240 horse-power per ton per twenty-four hours.

CARBIDE OF CALCIUM AND ACETYLENE. De Perrodil. "Prog. Age," April 1 and 15.—The beginning of a translation of a French work by that writer; it contains a preface by Moissan.

Units, Measurements and Instruments.

DETERMINING THE CAPACITY OF COILED CABLES. Dearlove. Lond. "Elec.," April 8.—A short article on the ballistic determination of the capacity of coiled cables. When these are longer than 200 nautical miles it is generally accepted that the ballistic method is practically useless; a modification proposed by him some time ago was to first connect the two ends of the cable together and then make the measurements; 300 to 400 miles of coiled cable have frequently been tested in this way, with satisfactory results; it eliminates the effect of induction and the resistance of the circuit is greatly reduced: the result depends to some extent on the period of the galvanometer and on the length of cable, but the true capacity up to 600 nautical miles can be accurately determined. He then gives the details of some tests recently made by him, the object of which was to find how much the gain in accuracy was due to the elimination of the effects of induction and how much to the reduction of the resistance; the results are given in a table, which shows that the total error when the ends were not connected was 18.5 per cent., of which 9.1 is due to the self-induction and 9.4 to the resistance. Other figures are given, which show the influence of the period of the galvanometer. He praises very highly the universal shunt of Ayrton and Mather in connection with the d'Arsonval galvanometer, which is quite unsuitable with the ordinary shunt, for cable measurements.

ELECTROLYTIC RESISTANCE. Kohlrausch, Holborn and Diesselhorst. "Wied. Ann., No. 3; abstracted in the Lond. "Elec.," April 8.—An important contribution from the Reichsanstalt, which is said to be a thorough paper on the subject; they recalculated the

mass of older figures, bringing them down to the C. G. S. system, and describe improvements in resistance measurements. In order to enable the conductivities of liquids to be compared with certain standards they carefully determined the conductivities of certain standard liquids at their point of maximum conductivity; unit conductivity is defined as that possessed by a liquid which has a resistance of 1 ohm between the sides of a centimetre cube; this conductivity multiplied by 10 to the ninth power gives the ordinary electro-magnetic conductivity. Unit conductivity is approximately possessed by the strong monobasic acids; accumulator acid has about 0.7, concentrated copper sulphate 0.05, mercury, 10,630 at 0° C. The point of maximum conductivity of sulphuric acid is at a density of 1.224, and the conductivity is then 0.7400 at 18° C.

INSTRUMENTS. Armagnat. "L'Eclairage Elec.," March 26.—Brief illustrated descriptions of some improved instruments. High resistances of several megohms made by a pencil mark on ebonite or ground glass change quite greatly and cannot stand more than exceedingly small currents; Mordey therefore proposes to coat a band of flexible insulating material with graphite and winding it as a spiral. To avoid having to make temperature corrections in very accurate resistance measurements Bell and Crompton wind three resistance wires on the coil, two of which are equal at a certain temperature and consist of a wire of an alloy and one of pure metal, having different temperature coefficients; the third wire is used to raise the temperature by means of a current to that required by the standards. Siemens & Halske devised an improved astatic couple, consisting of a small, short needle close to and above the upper one of the pair, and with poles in the same direction and a similar one below the lower; by adjusting these by turning on the axis the resultant action of a uniform field may be made zero. An ampere meter and a hot wire galvanometer are described and illustrated.

MEASURING THE RESISTANCE OF LAMPS. Apt and Hoffmann. "Elek. Zeit.," April 7.—A brief reply to the criticism (see "Digest," April 9) of their recently described method (see "Digest, March 19). They claim that their method is much more accurate than the usual one, and that the additional trouble is warranted where accuracy is required; the usual method in which the voltage and the current are measured is not sufficiently accurate for scientific researches, even though the necessary corrections are made; moreover, their method is applicable to lamps run with alternating currents. The galvanometer could be protected in case one of the lamps should break by lead fuses or a magnetic interrupter.

MEASURING THE RESISTANCE OF LAMPS. Apt and Hoffman. "L'Eclairage Elec.," March 26.—A long, illustrated abstract of the article noticed in the "Digest," March 19.

DIRECT MEASUREMENT OF FREQUENCY OF HERTZIAN WAVES. Decombe. "L'Eclairage Elec.," March 26.—An illustrated abstract of the Academy paper noticed in the "Digest," April 9.

STANDARDIZING OF A BALLISTIC GALVANOMETER WITH A SELF-INDUCTION. Wien. "Wied. Ann.," 62, page 702; abstracted briefly in "L'Eclairage Elec." April 2.

ATMOSPHERIC ELECTRICITY. Boernstein. "Wied. Ann.," 62, page 680; abstracted in "L'Eclairage Elec.," March 26.—He shows the influence of the electric charge of an aerostat on the observations made in balloon ascensions.

METER. Marks. "Jour. Frank. Inst.," April.—A very brief explanation, with an illustration, of the "American electric meter," taken from a recent paper at that Institute.

Telegraphy, Telephony and Signals.

WIRELESS TELEGRAPHY. Kennedy. Lond. "Elec." and "Elec. Eng.," April 8.—A brief abstract of a recent lecture, which is of an elementary character but gave some facts as to what had been done recently in England with signalling by Hertzian waves. He stated that the Post Office had severed its connection with Marconi and was making independent experiments. The most recent Post Office experiments were between Bournemouth and the Isle of Wight, over a distance of 18 miles of sea, the height of the vertical wires being about 90 feet; better signals were obtained, and the apparatus was more simple and portable, the transmitter being merely a 6-inch coil worked by a dry battery; the oil around the spark gap has been discarded and the size of the knobs considerably reduced.

TELEPHONY IN RUSSIA.—"Elek. Zeit.," April 7.—A reprint of a short report on the development of telephony under the control of the Government.

THE TELEPHONE QUESTION.—The London journals, April 8, contain various publications on the telephone question in Parliament and in Glasgow; they appear to be chiefly of local interest.

TELEPHONY.—"Elec. Eng'ing," April 1.—A number of short articles and notes in the interests of the Bell Company, including one on the Berliner patent, on the Independent Telephone Association, the relations of the Western Union to the Bell Company, telephone competition, etc.

ST. LOUIS. Bausch. "Elec. Eng.," April 21.—A long, illustrated description of the new Bell plant, to which 4000 subscribers are connected. The description includes the underground conduits.

WEST INDIAN CABLES.—"West. Elec.," April 16.—A map showing the existing cables and overhead lines in the West Indies, Central America, and the neighboring portions of North and South America. Havana is connected directly with Florida, but there are also several alternate cable routes to South America.

WIRELESS TELEGRAPHY.—"West. Elec.," April 16.—A reprint of the short, illustrated description of the portable apparatus mentioned in the "Digest," April 9.

WIRELESS TELEGRAPHY. Clarke. "El'ty," April 20.—A reprint of a short article and the beginning of the discussion, read before the New York Electrical Society. After an introduction, he describes his own experiments during the past few months.

Miscellaneous.

CARBONS. Jehl. Lond. "Elec.," April 8.—In this continuation of his long serial he gives facts concerning carbons and begins a description of the processes for manufacturing them. High-grade carbons are made principally in Germany; the factories of the United States make about ten times as many as all the European factories together, but the carbon is a low-grade one and is coppered; he considers that the term copper-covered carbon is sufficient to designate its inferior quality; European high-grade carbons appear to be sold in the United States at lower figures than in Europe, not including the duty.

ELECTRIC WELDING.—Lond. "Elec. Rev.," April 8.—Reprints of opinions concerning the success and failures of electric welding applied to defects in iron castings. Several claim that it is a failure, while a number of others give favorable reports; one objection was that the additional metal was so hard it could not be properly worked afterward.

ELECTRICAL ENERGY AND THE LAW. Meili. "Elek. Zeit.," April 7.—A reprint of a long article discussing the question in connection with the legal punishment for theft of electrical energy. In a short editorial article the proposition of the Union of German Electricians is given in the form of an amendment to the local law; this covers the case of theft of "work" in general, from a power installation of any kind, therefore including water power as well as electrical current.

ELECTROLYSIS OF STEEL BUILDING FOUNDATIONS.—"El'ty," April 20.—An editorial, quoting from a statement by Sooysmith in the Chicago "Tribune," who made an unofficial investigation of the buildings in Chicago. Unmistakable evidence of electrolysis at the foundations was found; he considers the question "alarming to the last degree"; he claims that a means of preventing "the escape of electricity into the ground from electric car tracks" must be found; he believes the discovery he made to be an extremely valuable one. It is claimed editorially that the solution of this important problem lies in properly controlling the return trolley currents; the three-wire system is suggested as a partial remedy. It appears to be thought that the trolley currents getting into the earth will affect the foundations of the buildings, but how they are supposed to accomplish this is not explained. (No mention is made of a thorough system of grounding the steel foundations by means of renewable ground plates to protect against grounded central station lighting and power circuits in the building itself.)

ENGLISH AND AMERICAN MANUFACTURE.—"Elec. Rev.," April 20.—A communication from an English engineer describing a number of American electrical manufacturing concerns which he visited. He concludes with some brief comparisons; he admits that America is ahead in street railway work, but in the general line of direct current lighting and the power plant there is not much advance; many of the auxiliary devices, such as starting switches, are highly ingenious, but too clumsy and crude to find favor with the English; the essential differences between English and American methods are that the former rely on theory and the latter on trial and error; the American standardizes his goods, while the Britisher builds more to specifications.

Book Review.

MODERN SWITCHBOARDS, and the appliances used thereon; together with an historical résumé of early practices and expedients, indicating the advance made in this class of electrical apparatus; and data on approved methods of construction, by Albert B. Herrick. Copyrighted by the Cutter Electrical & Manufacturing Company, Philadelphia, Pa. Price, $3.

The title of this volume leaves little for the reviewer to say, it is so concise and comprehensive. The work, which, we believe, is the first of its kind that is wholly devoted to this particular and important subject, is an artistic production in every department. The type is large and very clear, the illustrations of the highest order and both are printed on heavy plate paper. The construction of switchboards is illustrated in minute detail, and the diagrams of connections are particularly clear. Excellent illustrations of switchboard instruments are also given, and a handsome colored plate shows the different methods of making connections between conductors behind a switchboard.

The subject of the work is divided into eleven chapters, under the following heads: Circuit Breaking Devices; Switchboard Construction; Switchboard Appliances; Protective Devices; the Low-Tension Switchboard; Low-Tension Central Station Switchboards; Railway Switchboards; Alternating Current Switchboards; Arc Light and Special Switchboards; Circuit Breakers and Their Use in Power Transmission.

Apart from the great practical utility of the work, there is considerable matter of historical interest, which is in perfect harmony with the severely practical subject, for the reason that it tells us of the development of the switchboard from the early crude devices down to the modern structure. The book, which is written in a very clear style, free from ambiguity, has 153 pages of text and illustrations. It will no doubt fill a large place in electrical literature.

Electric Power in the San Rafael Paper Mills, Mexico.

The mills named are located near Tlalmanalso, district of Chalco. The following data regarding driving of the mills have been furnished by Mr. A. Woern, engineer of the company:

At present the mills are supplied with seventeen Pelton type wheels directly connected to their work. This power is augmented by electric power by apparatus of the General Electric Company. A 480-hp generator driven by Pelton wheel at 600 revolutions supplies three-phase current at 3200 volts from a distance of a mile and a half to a 400-hp synchronous motor at 200 revolutions, which drives two New England grinders and accessory machines for wood grinding. This electric plant has been in satisfactory service for about a year.

In the future changes will be made, for which apparatus is now under contract and construction. The former generator is to be replaced by two 500-hp Westinghouse generators, running at 212 revolutions, and a duplicate generator will be placed at a little over a mile from the mill at another water-power. The former generator will not be used, as it is desired to make the plant uniform, having all generators at a lower speed. The former motor will be continued in service, supplied from the new generators, and the Westinghouse induction motors will be added.

A 500-hp motor will drive at one end two new pulp grinders, and at the other end five beating engines.

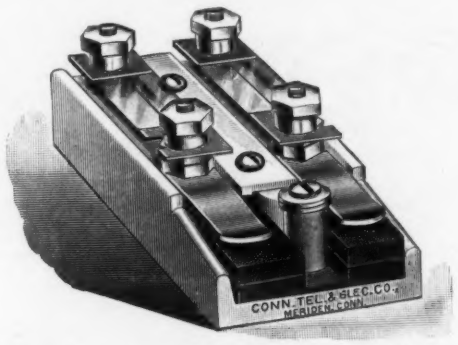
A 200-hp motor will drive a paper machine. The speed of the paper can be varied from 25 to 400 feet per minute, various speeds being attained by the cone pulleys and introduction of trains of gears from the standard motor speed.

Miscellaneous smaller motors will be used; 50 horse-power for supercalender, 50 horse-power for sulphite mill, 30 horse-power for shop and 25 horse-power for fan, pump, etc.

It is notable that this installation has grown from a small plant to a larger one, and that the new equipment is the alternating current system using induction motors.

Lightning and Sneak Current Arrester.

The lightning arrester shown in the accompanying illustration is of a type intended for use principally in protecting telephone switchboards and telephone or telegraph instruments. It is fitted with the well-known carbon and mica



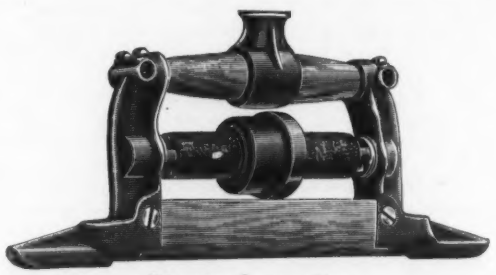
LIGHTNING AND STRAY CURRENT ARRESTER.

lightning arrester for protection against lightning, and with a fuse for protection against sneak currents as well as lightning.

While there are arresters on the market which will accomplish either of these results, the Connecticut Telephone & Electric Company, Meriden, Conn., recognized the desire for the combination of the two, and therefore devised the instrument shown. This arrester is said to be very efficient for the protection of any instrument on which it may be used.

The Hartford Section Insulator.

We illustrate herewith the Hartford section insulator for trolley lines, which is being sold by the H. W. Johns Manufacturing Company, New York. This insulator consists of end castings for the reception of the trolley wire, and obtains its great strength and high insulating qualities from the moulded mica-



SECTION INSULATOR.

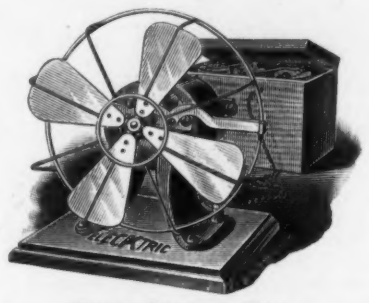
insulated bolts, which securely tie the end castings together. When under strain the upper wooden bar is under compression and no strain comes upon the bottom wooden bar, which furnishes a straight under running pathway for the trolley wheel. From pounding or arcing the wood break, which is 8 inches long in the clear, will in time require repairs. Opportunity for such repairs is specially provided for in the Hartford break. The wooden bar is readily removable, while the insulator is suspended in the air, and is quickly replacable by a simple and cheap stick of wood. The weight of the Hartford section insulator is only 6 pounds, and it is cheap, reliable and efficient.

Thermostatic Electric Cables.

An ingenious arrangement for rendering electric cables thermostatic has recently been put upon the market. There is considerable expense in equipping a large building with a sufficiently large number of thermostats to insure that in case of fire an alarm will be promptly given. All large buildings are nowadays wired for electric lights and telephones, signal bell and other service, and by a slight modification of these wires every inch of them can be made to act as a thermostat. This is done by the introduction in the cable of a pair of small conductors insulated from each other by a porous cloth and the insertion of a fusible alloy, the whole being mounted with the wires for the independent service, and costing for its installation but slightly more than the lighting and signaling wires alone. These thermostatic electric cables are manufactured by the Montauk Multiphase Cable Company, 100 Broadway, New York, and can be introduced in any make of wire and cable desired.

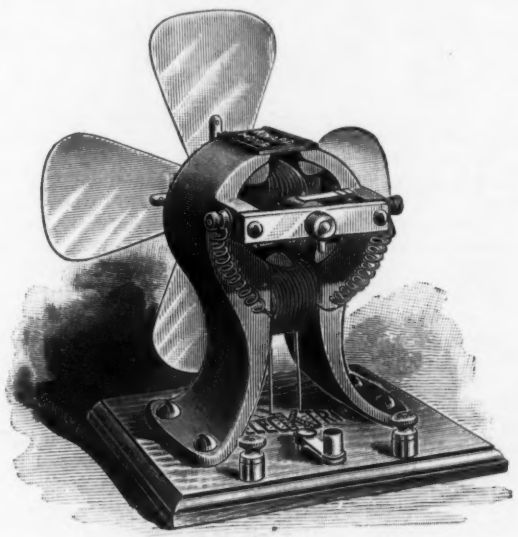
Battery Fan Motors.

The Knapp Fan Motor, manufactured by the Knapp Electric and Novelty Company, 47 Warren Street, New York, has been brought out in a new and improved form for the fan motor season of 1898. The smaller motors, known as type B, have a three-pole armature, but the larger motors, types C and D, have annealed cast iron slotted drum armatures, giving a six-tooth armature,



SMALL BATTERY FAN.

similar to those of larger machines. It is claimed that these and various other improvements have brought down the power consumption for a given breeze about 20 per cent. The motors will be sold this year by the Gordon-Burnham Battery Company, in combination with a battery of its construction with porcelain jars in a neatly finished case. The 6-inch fan is provided with two cells,



LARGER TYPE OF BATTERY FAN.

the 8-inch with three cells and the 10-inch with four cells of battery. But this combination will not affect the sale of the motor by the Knapp Electric and Novelty Company for use with any and all other batteries.

Dealers in Second-Hand Apparatus Enlarging Their Facilities.

Messrs. Rossiter, MacGovern & Co., the well-known dealers in second-hand electrical apparatus, 107 Liberty Street, New York, will, on or about May 1, move into new offices in the Washington Life Building, corner Broadway and Liberty Street. The firm has made an arrangement with Messrs. Stucky & Heck, Newark, N. J., whereby its stock will be carried and its repair work will be done at the factory of the latter. From information gathered there is reason to believe that Messrs. Rossiter, MacGovern & Co.

will have full control of the Stucky & Heck plant, which is one of the most modern and complete of its kind in this section. It possesses every facility for conducting a general repairing business, and has a fully equipped testing laboratory. It is located at 35-37 New Jersey Railroad Avenue, Newark, N. J., and is in close proximity to the Market Street station of the Pennsylvania Railroad. On account of this advantageous location, excellent shipping facilities are enjoyed. The consolidated interests will no doubt form a strong and important factor in the electrical business in this section of the country. All repaired apparatus will be put in first-class condition at the shops, and thoroughly tested before shipment, so that a machine coming from there will be practically as good as a new one in every respect.

Electrical Exposition Notes.

MR. CHAS. CHAMBERLAIN has been placed in charge of the Press Bureau of the Electrical Exhibition.

MR. C. O. BAKER, Jr., president of the Electrical Exhibition Company, has engaged a large banqueting room and parlors at the "Gerlach Hotel," 49-55 West Twenty-seventh Street, New York city, as a general meeting room and headquarters for delegates and visitors to the exhibition, which opens on May 2.

THE HEBREW TECHNICAL INSTITUTE has for some time past made a success of its instruction in the technical branches of electricity, as distinguished from the mere teaching in a manual or trade school. Evidences of the ability of the students under Mr. Ker will be given at the exhibition, where opportunity is being afforded for an excellent display of the electrical engineering skill of the boys. Not only will a number of instruments be entered for the model making competition, but these will be supplemented by other instruments and apparatus built by them to illustrate principles and phenomena. There will also be a complete small plant in operation lighting a small house. A collection of blue prints and photographs will also be included.

IN CONSEQUENCE of the illness of Prof. Sidney H. Short, and the fact that so many of the members of the New York Electrical Society are engaged in active work on the Electrical Exhibition, it has been decided to give Professor Short's lecture on "The Outlook of Heavy Electric Traction" during the exhibition. At the exhibition there will be various demonstrations of scientific phenomena and principles by means of models and apparatus, which will be in more or less continuous operation. As the society has been entrusted with a great deal of the work of this kind it would like to secure from among its members the help of volunteers to take charge of various features from time to time. The duty will not be heavy, but will be made as light as possible. The first applications will be selected, preference being given, as far as possible, in case there be a large number of applicants, to students of educational institutions. The assignment to duty will be in the hands of a committee of the society, and the Exhibition Company, and the work of such members will be publicly recognized.

HISTORICAL TABLEAUX.—A series of eight illustrative and historical wax tableaux (designed to mark some of the successive stages of electrical development), prepared by Dr. Park Benjamin, Prof. F. B. Crocker and Mr. T. C. Martin, executed and arranged by the Eden Musee Company, will be a feature in the Concert Hall. The series will include the First Recognition of an Electric Effect, when the Syrian woman, centuries before our era, wonderingly perceived light objects flying to her amber spindle; the Mariner's Compass, ascribed to the Chinese and Italians, but probably to be credited to the Finns, in the eleventh century; the Earth, a great magnet; William Gilbert explaining the Terella to Queen Elizabeth, 1600; the First Conductors or Circuits; Stephen Gray, a Charterhouse pensioner in London (1720), experimenting on the conduction of electricity; The Leyden Jar, showing the bottling of electricity and the terrible shock to Dean Von Kleist, canon of the Cathedral in Cumin, in Pomerania, 1746; The Identity of Lightning and Electricity—when Benjamin Franklin drew down the lightning from the skies, 1752; The Beginnings of the Modern Primary Battery or Voltaic Cell, with Galvani's famous frog experiment, 1791; and the Beginnings of Modern Dynamo-Electric Machinery, showing Michael Faraday's famous experiment, 1831. These tableaux are accompanied by a selection from Dr. Park Benjamin's celebrated library of early philosophical, technical and electrical books, each illustrating some feature or stage of electrical evolutions.

IN ADDITION to the list of names of exhibitors at the Electrical Exhibition, published in THE ELECTRICAL WORLD of February 19 and April 16, the following are announced:

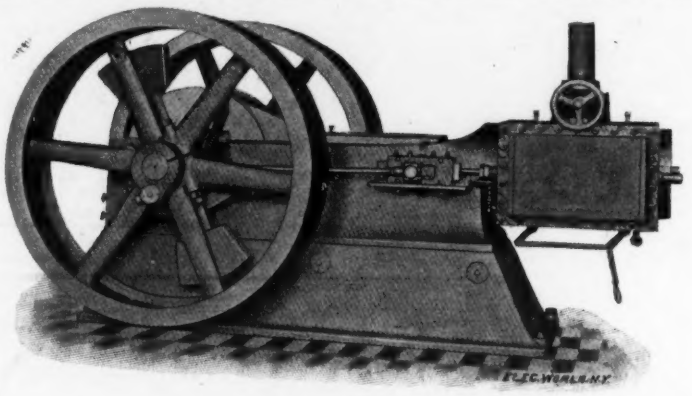
American Mutoscope Company, New York.
Ashcroft Manufacturing Company, New York.
Boston Blower Company, Hyde Park, Mass.
Berlin Iron Bridge Company, East Berlin, Conn.
Consolidated Safety Valve Company, New York.
Electric Vehicle Company, New York.
Hayden & Derby Manufacturing Company, New York.
Kaufman & Alexandre, New York.
Ward Leonard Electric Company, Bronxville, N. Y.
Montauk Multiphase Cable Company, New York.
Mergenthaler Linotype Company, New York.
Manhattan Electric Storage Battery Company, New York.
National Photograph Machine Company, New York.
National Phonograph Company, New York.
Nonpareil Cork Manufacturing Company, New York.
Sims Dudley Defense Company, New York.
Sheridan, T. W. & C. B., New York.
Stanley & Patterson, New York.
Thomson Press Company, John, New York.

THE NEW YORK TELEPHONE COMPANY will make an exhibit illustrative of the operation of the telephone system of this city. There will be shown specimens of the latest styles of telephone apparatus and silence booths for the equipment of public and private telephone stations. The exhibit will give visitors to the show a very fair idea of just how the service is worked, as part of the exhibit will be a switchboard in actual operation, which will serve stations at various points in the Exposition Building. Trunk lines will run from the exposition switchboard to one of the main exchanges, so that the stations in the exposition may not only be connected directly to one another, but also to any station in the city or in any part of the country reached by the telephone systems of the New York, the New York & New Jersey and the American Telephone & Telegraph Companies. In short, this part of the exhibit will be a working specimen of the private branch exchange system, which has been so largely adopted by big business houses of all classes since its introduction by the New York Telephone Company a year or two ago. Arrangements are also making for a separate telephone feature, which will be the transmission of music from various New York theatres and out-of-town points every evening during the month of the exposition. The Exposition Company, the American Telephone & Telegraph Company and the New York Telephone Company are working jointly in the production of this attraction, which is sure to be popular with the general public.

An Improved Double-Valve Automatic Engine.

The best types of "flat" single-valve, high-speed automatic engines, when operating at from three-tenths to four-tenths cut-off, will develop a hp-hour with approximately the same degree of economy as the four-valve, slow-speed engine of the same horse-power capacity, operating under the most favorable point of cut-off. At earlier points of cut-off, the economy of either type of engine is reduced, the reduction being much greater in the single-valve engine. The same is true for later points of cut-off, though to a lesser degree, so that under variable loads the average economy of the single-valve engine is much inferior to that of the four-valve engine. This is due, among other influences, to the increased cylinder condensation, a result of the necessarily high compression at these earlier points of cut-off, by which partially condensed steam is retained in the cylinder a longer time, reducing the temperature and consequently the pressure of the incoming steam. To overcome these disadvantages of the single-valve, high-speed engine, and to retain the other recognized advantages of this type of engine—simplicity of design, compact and self-contained construction, close regulation under extreme changes of load, adaptability for direct connection to dynamo, reduced first cost and (when efficient self-oiling devices are embodied) reduced cost of maintenance—led to the design of the double-valve engine, which has been brought to an unusually high state of development by the Fischer Foundry & Machine Company, in its improved Fischer double-valve, centre-crank, self-oiling, automatic engine, illustrated herewith.

This engine will compare very favorably in fuel economy with any design of four-valve engine of the same horse-power capacity on the market, operating under the same general conditions. Comparative tests of the double-valve



DOUBLE-VALVE AUTOMATIC ENGINE.

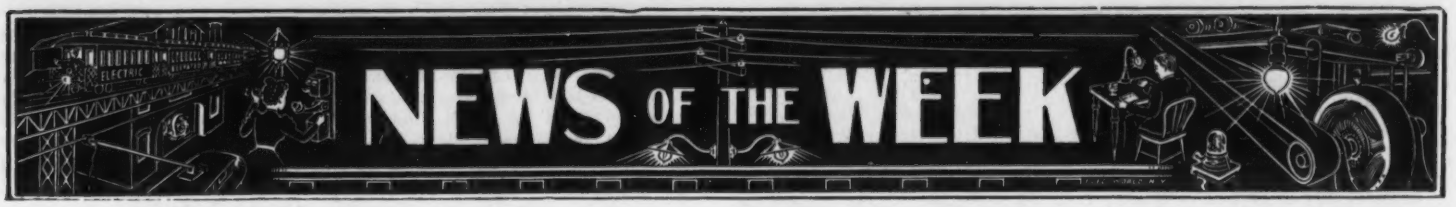
engine and one of the best single-valve engines on the market of the same size, and operating under the same conditions, showed an additional economy of 12 per cent. in favor of the double-valve engine at full load, and about 25 per cent. at one-quarter load, and an average of about 18½ per cent. under a load caused to vary in the same manner as in the case of a six-car traction road.

The steam and exhaust valves of this engine are four-ported. The steam valves are actuated by a shaft governor of the inertia type, of the simplest construction, and having special provisions for maintaining a stable and exceptional regulation under variable loads. Provisions are also made for detecting any misadjustment of the valves and for correcting the same without having access to the steam chest.

The main bearing is provided with a universal adjustment. The usual adjustments for wear can be made while the engine is in operation. The cross-head is provided with means for adjusting for wear readily and accurately. It can be removed from the engine, and replaced without disturbing any other parts and with the least amount of labor. The connecting rod can be adjusted for wear at either end by the simple manipulation of a set screw, and the construction is such as to make the displacement of any of the parts an impossibility. The automatic oiling device, which includes the main bearings, crank pin, cross-head, cross-head pin and valve-rod guides, embodies no pumps, piping or other details likely to get out of order. The disintegration of the oil by heating and churning is entirely avoided, and the replacing of the oil is rendered necessary at very long intervals only. The peculiarities of this oiling device permit of a design which make all the details of the engine fully as accessible as in the case of any of the cup-oiled engines, a very important feature.

The manufacturer of this engine makes single-valve cylinders, interchangeable with the double-valve cylinders on these engines, maintaining the same general details.

A full description in detail of this engine will be gladly furnished on application to the builders, the Fischer Foundry & Machine Company, Pittsburg, Pa., or any of its authorized representatives.



Financial Intelligence.

THE EDISON ELECTRIC ILLUMINATING COMPANY of New York reports gross earnings (inclusive of high-tension system) during March of $263,975.67, an increase of $56,105.20, as compared with the same item in 1897; the net earnings were $113,223.85, an increase of $18,804.92.

THE EDISON ELECTRIC ILLUMINATING COMPANY of Brooklyn reports gross earnings for March of $73,796, an increase of $2067 over the gross earnings of the same month last year. The operating expenses were $40,754, an increase of $2307. The net earnings show a decrease of $239.

A FINANCIAL PAPER states that the plan for a settlement with General Electric preferred stockholders and correction of capital impairment with probably not be submitted to the annual meeting of the stockholders, which will be held on May 10. Changes in plans, due to the Spanish complications, is given as the reason for this.

Special Correspondence.

New York Notes.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, April 26, 1898.

MR. GEORGE W. RIANHARD, general manager of the Prismatic Electric Sign Company, Williamsport, Pa., visited New York last week to establish a New York office for his company. The exact location has not yet been determined, but the office will represent the territory of all the New England States as well as Greater New York.

THE HENRY ELECTRICAL SOCIETY will hold its one hundred and second meeting on the evening of Friday, April 29, in the Engineering Building of Columbia University. Prof. F. B. Crocker will address the members on "The Design of Circuits for Electrical Distribution," the questions of regulation being illustrated by numerous experiments.

A TEMPORARY INJUNCTION was granted on April 19 by Justice Van Wyck in the Supreme Court in Brooklyn, restraining the Kings County Traction Company from parting with any of its assets or with its right, title and interest in the capital stock of the Atlantic Avenue Railroad Company. The proceedings were begun by Crowell Hadden, a shareholder of the traction company.

THE NEW YORK ELECTRICAL EXHIBITION.—The Electrical Exhibition Company is sending out directions to exhibitors as to how to enter their goods at the Madison Square Garden. The goods should be consigned to the exhibitor himself, in care of Madison Square Garden, New York. All exhibits must be received and placed not later than Saturday, April 30. Several contractors will be on hand at the Garden from April 25 to April 30 to arrange for decorations, railings, painting, etc.

New England Note.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Build'ng, 690 Atlantic Ave.,
BOSTON, Mass., April 25, 1898.

A SUMMARY of the winter's business of the Lynn Incandescent Company shows that nine out of ten of its shipments are to old customers, and that five out of eight are to lighting stations. This shows that station managers are appreciating the efforts of this company to furnish them with a good lamp at reduced cost, and that it is making it possible and profitable for the station manager to use lamps of a higher efficiency, and to replace them oftener. Mr. E. F. Dwyer, president and manager, says: "It has been a much disputed point as to whether it is cheaper to put money into the renewal of lamps or to use a lamp consuming more power and of longer life than to put money into coal. The nice, bright, clear light of a higher efficiency lamp is certainly the most satisfactory to the customer. The renewal of incandescent lamps is certainly destined to play an important part in the economy of station practice in the future. Other companies, too, are realizing this, and every few weeks we see a new company entering the field to carry on this same work." The Lynn Lamp Company however, we believe, is entitled to be considered the pioneer and the largest company.

Philadelphia Notes.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., April 25, 1898.

A. M. WORSTALL & CO., Witherspoon Building, Philadelphia, has been awarded the contract for the construction of the exchange and toll line of the Standard Telephone Company, of Newton, Pa. The Standard Company is capitalized at $10,000.

THE TECHNIC ELECTRICAL WORKS, of this city, last week made a record for itself in filling an important order. On Thursday night it received an order from the War Department, in New York, for seventy-two 100-ampere, double-pole, knife switches for harbor defense purposes. The company worked them up from raw material, and shipped the goods complete on Friday night, thus filling the contract in twenty-four hours.

THE MANAGEMENT of the Philadelphia Electrical Exposition has received inquiries from different sources as to whether or not that enterprise is a branch of the New York Electrical Exhibition. The management desires it to be understood that there is no connection between the two. The Philadelphia exhibition happens to follow the one in New York, opening one week after the close of the latter. The friendliest possible relations exist between the managers of the two enterprises, however, and it is hoped that everything that is attractive to the general public shown by the New York company will find a place in the Philadelphia exhibition. In many respects the latter will differ widely from the exhibition given in New York. The management has made special arrangement for the elaborate decoration of its building by its architect, and in this point hopes to surpass anything that has ever been done in the past. It has also arranged and well nigh completed an electrical cataract which is a reproduction of one used with great success at the Opera Ball in Paris. It has secured the kinetescope and the cinematograph. The X-ray apparatus with a screen will be constantly in operation, an electric fountain with kaledoscopic effects produced by rapidly moving lights is now being built and arrangements have been effected for the use of large quantities of decorative foliage plants in connection with electric lights. While the commercial character of the exhibition so far as selling on the spot is concerned will undoubtedly be a feature, the company will be very careful to limit the exhibitions to those purely electrical. It will avoid as much as possible exhibits of allied industries, which might be used for other than electrical purposes. The company has secured phonographic speeches from distinguished inventors and electricians, and these will be given at regular intervals.

Buffalo and Niagara Falls Notes.

BUFFALO, N. Y., April 23, 1898.

SECRETARY DE LANCEY RANKINE, of the Cataract Power and Conduit Company, is to be married June 8 to Miss Gertrude R. Packard, of Niagara Falls. Mr. Rankine is a brother of the secretary of the Cataract Construction Company. Miss Packard is a member of one of the first families of the Falls City.

THE FOLLOWING NAMED GENTLEMEN have been elected directors of the Buffalo General Electric Company, at the meeting recently held: Daniel O'Day, George Urban, Jr., J. T. Jones, J. M. Brinker, R. L. Fryer, Wilson S. Bissell, Charles R. Huntley, Samuel S. Spaulding, Franklin D. Locke, H. W. Burt, S. Dana Greene and P. P. Miller.

THE CONDUITS connecting the Niagara power line with the new lighting station on Wilkeson Street, in Buffalo, are already partly laid, and the building is to be finished about May 15. It is expected that some of it will be in use by July 4. When it is complete the world will be invited to inspect a plant the most complete in existence, and one that far exceeds any other of its kind in the manner and diversity of its work.

THE NEW ELECTRICIANS' CLUB, which has been in existence here some time on such informal lines that it had no name and no officers, has now been christened the Potential Club. Meetings are held at the members' houses, the first Monday evening of the month being the regular session night. The host is the president for the time. Among new members is Superintendent Danforth, of the Buffalo (street) Railway Company.

STEPS ARE BEING TAKEN to begin the generation of electricity on a larger scale on the Canadian side of Niagara Falls. The power house of the Victoria Park Railway Company is already a power tunnel plant on a small scale, and the amount that can be generated there could be increased without great outlay to over 2000 horse-power. When it becomes necessary to turn this into a tunnel of considerable size the work can be done cheaply, for the tail race or tunnel proper, will need to be only a few rods long, whereas the one in use on this side is more than a mile long.

SOME INTERESTING COMPUTATIONS have been made of the cost of Niagara power since the appearance of the price schedule last week. For instance, it is found that the Urban flour mill, which was first in the field (Mr. Urban being president of the transmission company), should it take 300 horse-power, will pay a fraction less than $27 per horse-power per year. Extra apparatus will cost about $3000, interest on and depreciation of which ought to be counted with the cost. The running cost is about two-fifths taken up by the item for service at 75 cents per horse-power per month. As the cost of steam is held never to be less than $35 per horse-power per year and usually much more, this is a great saving without making any account of the fact that there is to be no cost when the mill is idle, and that the amount used can be varied at will, all expense for power being by meter. It should be said that the use of electric power in the Urban mill involves a specially difficult problem, as the engine room is very small, the engine is a left-handed one, and it is the plan to retain the steam power intact, at least for a time, by means of a spur gear.

Pittsburg Notes.

Pittsburg, Pa., April 23, 1898.

ELECTRIC POWER FOR A COAL MINE.—The Beadling Brothers have arranged for extensive improvements in their coal mine at Beadling, Pa. Electric power will be adopted throughout the mine, and contracts have been made for two 50-hp electric locomotives. The output of the mine will be increased to 2250 or 2300 tons per day.

WEST END RESIDENTS WANT LOWER FARES.—Citizens of the Chartiers Valley are making strenuous efforts to induce the West End Traction Company to establish 5-cent fares on its line. On April 9 a mass meeting of property owners of Crafton, Ingram and Sheraden boroughs was held in Crafton, at which a committee which had been appointed to confer with the traction officials reported that the latter had refused to consider a reduction of the present 10-cent rate of fare. Much indignation was expressed against the management of the company, and a resolution was adopted pledging those present at the meeting to use only the Pan Handle Railroad in traveling to and from the city after May 1.

PREPARATIONS FOR THE KNIGHTS TEMPLAR CONCLAVE.—A prominent feature of the Knights Templar Conclave which is to be held in Pittsburg next October will be the electrical display. The committee on decorations and illuminations has been at work for months elaborating plans for electrical effects. One of the plans announced is the scheme of a number of brilliantly illuminated street arches of various appropriate designs. These will be erected on Federal Street in Allegheny, one at every cross street between North Avenue and the river. On the Pittsburg side of the river numerous single and double arches will be placed along Sixth Street, and along Fifth Avenue, below Grant Street. An arch will also be erected at each end of the Smithfield Street Bridge. Many thousand incandescent lamps will be required for the illumination of these arches, and the effect will undoubtedly be beautiful and imposing.

ELECTRIC LIGHT PLANT FOR THE WESTERN PENITENTIARY.—Contracts have been awarded for apparatus for the electric lighting plant of the Western Penitentiary in Allegheny, and the work of construction will be pushed actively. The dynamos will be two 75-kw Westinghouse machines, connected direct to two 125-hp Imperial engines, manufactured by the Weston Engine Company, of Painted Post, N. Y. More than 2000 16-cp incandescent lamps will be installed, and thirty arc lamps of the enclosed arc type are to be furnished. A storage battery of ample capacity to carry the entire load for several hours will be supplied, in order to guard against any emergency of breakdowns or necessity of shutting down for repairs. The construction of the new building in which the plant is to be located will be done by the convicts, whho will also do all of the wiring. No outside labor will be employed except what is absolutely necessary for superintendence, etc. The arrangement of the plant and the plans for the wiring are such as to reduce to a minimum the risk of accidental or intentional interruption to any portion of the lighting service.

Milwaukee Notes.

Milwaukee, Wis., April 21, 1898.

THE SOUTH MILWAUKEE Council has declared for municipal ownership of the electric lighting plant, which has long been a private company.

THE FOX RIVER VALLEY INTERURBAN RAILWAY has secured the services of W. H. Holcomb, of Chicago, as general manager. The line will be opened at an early date.

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY is equipping the Milwaukee & Whitefish Bay Railroad electrically. Formerly the road was operated by dummy engines.

TRACK IS BEING LAID on the Waukesha extension of the Milwaukee Electric Railway & Light Company at a very rapid rate. Indications point to the completion of the extension by May 1.

St. Louis Notes.

St. Louis, Mo., April 22, 1898.

THE DIRECTORS of the East St. Louis & Belleville Electric Street Car Company held a meeting last week, and decided to increase the capital stock from $50,000 to $150,000.

THE SOUTH BROADWAY MERCHANTS' ASSOCIATION will have introduced at the next meeting of the City Council a bill which provides for a street railway from South Broadway to Lower Grove Park.

ARTICLES OF INCORPORATION of the Madison Telephone Company were filed at Belleville, Ill., April 16. The capital stock is $20,000. The incorporators are W. H. Johnson, B. L. Behr, E. W. Lagell and J. Wright.

MR. J. A. MEHLING, of Cleveland, Ohio, promotor of the proposed electric road from Venice to Edwardsville, has secured the right of way for almost the entire route, and expects soon to be ready to begin work on the line. The lines of the Venice, Madison and Granite City Railway Company will probably be used as a part of the new line.

THE DIRECTORS of the Laclede Gaslight Company at a meeting last week decided not to place their electric light wires underground. The decision by the United States Supreme Court bars the company from making excavations in St. Louis streets without obtaining permission from the city. The directors say that as they failed to apply for a permit under the Keyes ordinance they cannot now build conduits even if they want to. The company's contract with the city runs for two years longer, and the directors say their wires will remain above ground until the expiration of that time.

THE ATTORNEY-GENERAL of Missouri is preparing quo warranto papers, asking the Supreme Court for a writ of ouster against the Central Traction Company, which secured a franchise from the St. Louis Assembly over the Mayor's veto. He will proceed to establish the validity of the Julian law, which provides that franchises must be sold to the highest bidder, and which he holds has been violated by the St. Louis law makers. Meanwhile the company is negotiating for steel and rolling stock, and will in a few days announce formally the acceptance of the contract. If the alternative writ is granted it will stop all proceedings until the Supreme Court settles the status of the Julian measure.

Mexican Notes.

Monterey, Mexico, April 18, 1898.

THE WORK of constructing a street railway in the city of Cuernavaco, capital of the State of Moreos, Mexico, has begun. The road will run to all of the principal points of interest about the ancient town. It will be completed and placed in operation in about three months. Mr. William T. Pritchard is manager of the proposed system.

THE NEW private electric light plant which was recently installed on the hacienda of Querendaro, State of Michoacan, has been inaugurated, the event being marked by the presence of the Governor of the State and a number of other distinguished Government officials. This plant was installed by Mr. A. E. Lawrence, an electrician of Morelia, Mexico.

Pacific Coast Notes.

San Francisco, Cal., April 16, 1898.

THE ECONOMIC LIGHT & HEAT COMPANY, of Los Angeles, Cal., was recently incorporated by capitalists of Southern California, who have subscribed all of the $60,000 capital stock. The directors are: R. S. Lawrence, A. Brogden, W. W. Brown, C. A. Robinson and A. S. Stinson.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY has closed contracts amounting to $24,000 for enlargement and alteration of the Telephone Building, occupied by its central telephone station. There are now about 12,000 'phones in this city, which has a population of 300,000. Rapid progress is being made in making house connections by conduits, and then removing poles.

THE UNITED STATES GOVERNMENT is pushing the work of protecting the Pacific Coast electrically. Torpedoes have been planted here, and electrical apparatus for operating the same has been supplied for both San Francisco Bay and the defenses at the entrance to the Columbia River. First Lieutenant Frank Green, chief signal officer of the Department of California, will have charge of connecting electrically the posts in San Francisco harbor.

THE PELTON COMPANY is remodelling the Pelton-type wheels, built by the Abner Doble Company, for the Blue Lakes Water Company's electric plant, Blue Lakes City, Cal., and found lacking in efficiency. The Pelton Company is now constructing two 600-hp wheels, to be operated under 590 feet head, for the British Columbia Electric Railway Company's Victoria transmission plant, located at Gold Stream. They will be directly connected to Canadian General Electric three-phase generators.

THE SNOQUALMIE FALLS POWER COMPANY, of Seattle, Wash., which is preparing to transmit electric power to Seattle and other cities, has built a coffer dam at the headworks, and is sinking a shaft 8 by 25 feet through basaltic rock for a distance of 250 feet. Mr. W. T. Baker, representing the company, was recently granted permission to erect poles and string wires along the highways of King County, between the falls and Renton; between Renton and Seattle, and between Renton and the southern boundary of the county.

MR. W. F. C. HASSON, of Hasson & Hunt, is in Victoria, B. C., where he is engineering the British Columbia Electric Railway Company's 10,000-volt transmission plant. He will also make reports upon the street railway systems of Victoria and of Vancouver, B. C., with a view to increasing their efficiency and capacity. His firm did work of this sort for the Los Angeles Railway Company, and remodelled the system with satisfactory results. The 12-mile pole line for the new transmission is being erected by Mr. Wyn Meredith, construction engineer for Hasson & Hunt.

AMONG THE RECENT CONTRACTS of the Pelton Water Wheel Company, San Francisco, are a 150-hp wheel for driving two dynamos in Auckland, New Zealand; a 200-hp wheel for an electric lighting plant in La Paz, Bolivia; a wheel for 150-hp steam and water power electric plant of the Ventura (Cal.) Land & Power Company; a 700-hp installation, which will operate an electric power station near Yokohama, Japan; a 1200-hp plant for the Odawara Electric Railway Company, to be located near Yokohama; three sets of 200-hp wheels, to be operated under a head of 1100 feet, directly connected to the electric generators for the Rawhide Mine, Cal.

Canadian Notes.

Montreal, Que., April 23, 1898.

THE RATE PAYERS of Campbellton, N. B., have voted in favor of electric light.

THE GALT & PRESTON ELECTRIC RAILWAY will likely extend its line to Berlin, Ont.

THE MOUNTAIN TRAMWAY & ELECTRIC COMPANY, Victoria, B. C., will seek for incorporation by private bill at the approaching session of the Legislature.

THE WALLACEBURG ELECTRIC LIGHT COMPANY, Wallaceburg, Ont., contemplates putting in an incandescent plant, having agreed to do so within eight months.

KINGSTON, ONT.—The Kingston & Smith's railway promoters will, it is said, ask for a new charter, with power to build an electric railway between this city and Ottawa.

A MEETING was held at Bolcaygem, Ont., last week to discuss the electric railway project. A committee was appointed to take steps to form a company to build an electric road connecting Fenelon Falls, Bobcaygem and Peterboro. W. J. Reed is acting secretary.

A COMPANY is said to have been formed and plans matured for building an electric railway between St. Catherines, Ont., and Port Dalhousie, ready for operating April next. H. D. Symmes, manager of the St. Catherines & Thorold Railway, is at the head of the new company.

A COMPANY IN DETROIT has made a proposition to build an electric railway from Amherstburg, Ont., to Windsor and Harrow, and wants a bonus of $15,000. Mr. Joseph De Curse, C. E., has made estimates for grading, bridges, culverts, etc. Several bridges will be required if the road is proceeded with.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, April 13, 1898.

THE BRITISH ELECTRIC TRACTION COMPANY.—At a recent meeting of the shareholders of the British Electric Traction Company, Limited, the chairman, Sir Charles Rivers Wilson, K. C. M. G., C. B., made an important speech, which threw considerable light upon the prospective development of electric traction in the United Kingdom. This company has no less than eighteen undertakings well developed and likely to be completed shortly, beside a number of others in a preliminary stage of negotiation, making a total of no less than fifty projected electric traction undertakings in all. Some of these, such, for instance, as the scheme for the development of the tramways in the South Staffordshire district, represent separately as many as 50 miles of track, and will serve a population of nearly half a million, and the total mileage in the schemes about to be developed is over 200. When it is remembered that there are only about 1000 miles of tramways of any sort in the United Kingdom, and not quite 10 per cent. of these are worked by electricity, it will be seen that these schemes are of considerable importance. When completed they will represent a capital outlay of something like 3,000,000 sterling.

THE MUNICIPALIZATION OF TRAMWAYS IN GREAT BRITAIN.—With a certain section of the community the municipalization of public works of all kinds is a very popular political move, and the extremists of this section are in favor of the municipalization of every undertaking of a public nature. Already considerably more than half of the electric supply concerns in this country are controlled by local authorities, and many of these latter are seeking powers to acquire, and work the tramways in their areas. The advent of electric traction in this country is giving considerable impetus to the development of long distance interurban lines passing through districts controlled by several local authorities, and it is feared by many that the tendency to municipalization will hinder the development of this class of electric line, for it is difficult to see how a line can be worked successfully if its various sections are separately operated and controlled by the numerous local authorities within whose areas these sections happen to lie. The local authorities themselves are unable to acquire powers to work or in any way control lines which extend beyond their own areas, neither are they allowed to borrow money for the purpose of laying down or altering in any way such lines, and these restrictions are likely to lead to considerable difficulties in connecting several networks of tramways in neighboring towns.

FRENCH NOTES.

(From Our Own Correspondent.)

PARIS, April 14, 1898.

ELECTRIC TRACTION IN FRANCE.—Electric traction is being more and more developed in the greater part of the large cities. Some have a complete system and make yearly additions. Cities of the third and fourth order do not wish, as is natural, to be left behind, and all desire electric traction, so that little by little progress is gaining on all sides. Thus among the most recent projects definitely accepted and under construction may be cited: Evreux, in the department of the Eure, which has just turned over the problem of municipal tramways to the study of a commission, and Epinal, in the Vosges, which has accepted a proposition from the Parisian company that has already installed roads at Chalons, Sedan, Bordeaux, Asnieres and Havre. This company has asked of the town no guarantee of interest on its investment. The fare will be 0.15 franc (3 cents). Another company which is a concessionnaire of railway privileges at Besancon, has recently made even more advantageous propositions to the town of Epinal. St. Brieuc will also be served by two lines of electric tramway. Castres, in Tarn, has just voted for the building of electric lines, and, finally, at Lyons, the suburban lines have just been opened to the public and three similar lines are under construction.

ELECTRIC SPARKS AND FIRE DAMP.—MM. Couriot and Meunier have lately shown that mixtures of air and fire damp are not ignited by an incandescent metallic filament, and that they explode by the spark of rupture of such a conductor. There are other circumstances under which a spark can take place in the mixture without causing an explosion. After having demonstrated that mixtures of 9.5 per cent. of methane with air are the most explosive it was considered reasonable to experiment only with these mixtures, for it is certain that the conditions under which their explosion may be avoided are sufficient to prevent the explosion of other less dangerous mixtures. In the first experiments the tension of the current was kept constant at that of the mains of the Ville de Paris Electric Light Company—about 110 volts. Lower voltages were obtained by shunts in the circuit. From the results thus observed the following principles were deduced: Rule of Shunts—To avoid explosion it is necessary to connect by a secondary conductor the two points of the circuit between which the spark is formed. This condition is necessary because, by the use of a shunt, it is possible to melt piano wire in a 9.5 per cent. methane mixture without starting an explosion, while without the shunt this always produced ignition of the mixture. This condition does not always suffice. The conductors bringing the current to the laboratory for the experiments were in shunt upon the whole lighting system of the station. Secondary conductors employed in the apparatus itself were not always sufficient to prevent an explosion. There is therefore an opportunity here for further research to discover the other conditions that should be observed in connection with the first. The experimental method is as follows: The explosion chamber is mounted in series with an ammeter, and around it are shunted a voltmeter and the shunt connection, the instruments serving to give the resistance of the two branches of the circuit. The current flowing in the system is increased until the wire in the explosion chamber melts and forms an arc. The resistance of the shunt, beginning low, is then increased until, after successive experiments, an explosion takes place. When the ratio of the resistances is high, that is, when the resistance of the shunt is much higher than that of the explosion chamber circuit, an explosion always takes place. MM. Couriot and Meunier used in one case a 110-volt lamp, passing a current of about one ampere as the shunt, and a copper wire of three ohms resistance to form the circuit containing the explosion apparatus. At all values of the total current between 4.5 and 7.6 amperes explosion invariably occurred, while a shunt of copper wire paralleling the lamp shunt entirely obviated it. As a corollary of the principle of shunts enunciated and of these facts it can be deduced that the spark produced in a simple circuit, of which the rupture causes the complete extinction of the current, invariably and necessarily causes an explosion. To determine the lower limit of the intensity of current to which this principle is applicable it is necessary to use decreasing currents, but the practical difficulty of procuring metallic filaments small enough to fuse under the action of these small currents presents itself. With silver wires one-half mm. (1-15 inch) diameter, the smallest commercial size, the almost invisible sparks due to their rupture under a current of 1.9 amperes is sufficient to start a detonation. By using lamps rupture of the filament can take place at much less values of the current. The explosion is most easily avoided when the ratio between the resistance of the exploder circuit and that of the shunt approaches unity. When the resistance of the shunt becomes less than that of the other circuit a point is reached at which the explosions begin anew. There are, then, two limits of this ratio, one above and the other below unity, between which explosions can be avoided when the current strength involved does not surpass a certain limit. With the apparatus arranged so that the two circuits are of equal resistance it was found that to avoid the explosion of the most dangerous proportions of air and methane the current should not exceed 11.5 amperes when the resistance of each branch is 0.75 ohm, 5.6 amperes for 3.3 ohms, and 4.1 amperes for 4.4 ohms.

MEETING OF THE INTERNATIONAL SOCIETY OF ELECTRICIANS.—The general meeting of this society was held on April 6. Officers for the years 1899-1900 were elected as follows: President, M. J. Violle; vice-presidents, MM. Clérac and Monnier; secretaries, MM. Abraham and Grosselin; treasurer, M. L. Violet. M. J. Laffargue made an address on the electrical distribution of power in Germany. He recalled the fact that the statistics of 1897 showed a total of 265 stations, with an aggregate power of 67,900 kilowatts. Of these stations there are 204 utilizing continuous current, with an aggregate power of 54,273 kilowatts. By September 1, 1897, there was a total length of 957 kilometres in tramways in fifty-six different cities. The speaker then described the installations of some of the towns, and brought out some of their peculiarities. At Frankfort, the municipal station contains four alternators of 500 kilowatts each at 300 volts, and a fifth generator of 1000 kilowatts is to be added. The use of power is beginning to develop, this amounting on March 31, 1897, to 133 motors, and an aggregate of 1063 horse-power. The speaker mentioned in particular the installation of the "Frankfurter Zeitung," which he had visited. The city of Cologne has owned since 1891 a splendid central station distributing alternating current at 2000 volts. It contains Sulzer horizontal compound engines of 600 horse-power at 85 turns per minute, driving four Helios 450-kw alternators. The distributing system is underground in armored lead covered cables placed in wooden conduits. Public lighting is not yet very largely developed, there being only thirty arc lamps. There are thirty-five electric motors on the system. At Dusseldorf the distribution is effected from a central station situated about 30 kilometres from the town, feeding three sub-stations more centrally situated. The generating station contains two horizontal compound engines of 300 horse-power and one of 400 horse-power. The first two machines each drive a Schuckert 250-kw dynamo, giving 400 volts, and a third drives two Schuckert dynamos of 150-kw each at the same voltage. The distributing cables, supplied by Felten & Guilleaume, are lead covered and armored. A small traction system is in use, driven from a special station. In Hamburg there may be found on Carolinenstrasse a magnificent central station which supplies the lighting system and also furnishes power for the tramways. This station contains six vertical triple expansion engines of 1200 horse-power each and eleven dynamos, of which four are rated at 500 kilowatts and 300 volts, six at 500 kilowatts and 600 volts, and one at 1000 kilowatts and 600 volts. Mention should also be made of the Postsstrasse station, which contains five compound engines of 500 horse-power each. The central stations at Berlin are four in number, all feeding the same distribution network. The Markgrafenstrasse power plant consists of six 300-hp machines and three 400-kw three-phase transformers, connected by special lines with the Schiffbauerdamm station. The Nauerstrasse station contains two 300-hp engines, four 1000-hp and two 1500-hp engines, two 230-kw and four 360-kw and four 650-kw dynamos. The Spandauerstrasse plant now consists of three units of 1000 horse-power each and four of 1500. The

Schiffbauerdamm station contains three 1000-hp and two 1500-hp engines and six continuous current dynamos of 364 kilowatts capacity each, and two three-phase 300-volt alternators. The Augustastrasse sub-station is fitted with two batteries of 140 accumulator cells. Mention was also made of the Oberspree station, now under construction, and also of the traction systems with overhead trolley and underground conduits and with accumulator cars, as well as of some magnificent plants now being built by the Allgemeine Elektricitats Gesellschaft and by Messrs. Siemens & Halske. The city of Leipsic possesses also a central station for the distribution of continuous current on the three-wire system with transmission of three-phase currents and a sub-station at the centre of distribution. In Leipsic there are two traction systems. The city of Munich at present distributes power only for public lighting by about 850 arc lamps and for traction purposes, and it is proposed to install three central stations with a aggregate of 21,000 horse-power, using three-phase currents. A private company in Strasbourg distributes three-phase current for lighting and also generates power for traction. The price at which electrical energy is sold in Germany does not exceed as a rule for lighting 16 to 20 cents per kw hour, and for power purposes 4 to 6 cents per kw hour. This latter application is quite well developed, there being, for example, in use in Berlin in July, 1897, 2056 motors, with an aggregate of 7475 horse-power.

THE ELECTRIC POWER STATION AT MONACO.—The first electric station at Monaco, built in 1890 by the Société Monégasque d'Electricité, has not been sufficient for a long time on account of the continually increasing extension of the service to hotels, restaurants, etc. Furthermore, Monaco and Monte Carlo being without tramways, the company undertook to establish a new station for traction and lighting. The only place that could be found for the new station is at the foot of a cliff on the shore where the town sewage is thrown. This was because land at Monaco is as high in price as that upon the boulevards of Paris, and even then hard to find for sale anywhere within the limits of the principality. The location referred to is about 500 yards from the railway station, and is on quicksand, which had to be strengthened with concrete piers 12 feet at the base and a filling to a height of 16 feet above sea level. Upon this foundation is built the station. Multitubular boilers of the Babcock & Wilcox type are used, having a heating surface of 6400 square feet and a production of 22,000 pounds of steam per hour. The steam piping is of the type called à boucle (closed circuit trunk system). There are two units of 200 kilowatts, each using dynamos of the Thury type, for furnishing current to the tramway, working at the usual 500 volts. Two other units, the dynamos being alternators of the Zipernowski type, of 120 kilowatts each, supply current at 2000 volts in connection with the old station to the lighting mains. All the electrical material of this installation was furnished by the house of Lombard Gérin et Cie., of Lyons, representing the Creusot works. All the dynamos are excited by two 40-hp units, which also serve to recharge the accumulators of the electric cabs, these having of late made their appearance at Monaco. The Farcot works also contributed to the equipment of the station by furnishing the two engines working the traction dynamos, the self-contained condenser, etc.

General News.

THE CITIZENS TELEPHONE COMPANY, Cambridge City, Ind., has been organized with a capital stock of $10,000.

THE PEOPLES ELECTRIC LIGHT, HEAT & POWER COMPANY, Gettysburg, Pa., has been incorporated with a capital stock of $2000.

THE STANDARD ELECTRIC MAGNETIC POWER COMPANY, Martinsburg, W. Va., has been incorporated with a capital stock of $5,000,000.

THE HIGHLAND GROVE TRACTION COMPANY, McKeesport, Pa., has been formed with a capital stock of $12,000. T. H. Bowman is president.

THE LAKE COUNTY TELEPHONE COMPANY, Libertyville, Ill., has been formed by James Turnrock, Joseph A. Seyle and T. Regen, with a capital stock of $2500.

THE DECATUR GAS & ELECTRIC COMPANY, Decatur, Ill., has been formed with a capital stock of $400,000. The incorporators are W. C. Jones, G. C. Danforth and Joseph Housum.

THE JANESVILLE TELEPHONE COMPANY has been incorporated at Janesville, Wis., with a capital stock of $25,000. The incorporators are Frank E. Bell, Frank T. Brewster and F. R. Bentley.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, Ill. has been incorporated with a capital stock of $100,000. The incorporators are C. C. Bulkley, W. D. Latimer and W. B. Jarvis.

THE UNION CARBIDE COMPANY, Niagara Falls, N. Y., has been incorporated at Albany as a successor of the Acetylene Light, Heat & Power Company. The capital stock of the company is $50,000.

THE LONG DISTANCE TELEPHONE COMPANY, Chicago, Ill., has been incorporated with a capital stock of $2,500, by E. C. Cleveland, W. D. Latimer and W. B. Jarvis.

THE CANTON CO-OPERATIVE TELEPHONE COMPANY, Canton, S. Dak., has been formed with the following named officers: C. E. Judd, president; M. L. Syverud, vice-president; F. H. Bacon, secretary; C. M. Seely, treasurer.

THE CARBIDE LIGHTING COMPANY, of Niagara Falls, N. Y., has been incorporated with a capital stock of $100,000. The directors are J. P. Devine, Buffalo; J. B. Rice, Cambridge; J. C. Frost, Niagara Falls; Frederick Overburg, New York City.

THE MUTUAL TELEPHONE COMPANY, Pueblo, Col., has been formed with a capital stock of $55,000. The incorporators are G. F. Stodghill, John H. Olmes, W. H. Thompson, J. G. Chapman, F. L. Cuddeback, E. E. Hubbell and Francis I. Meston.

THE CENTRAL TELEPHONE COMPANY has been incorporated at Des Moines, Ia., with a capital stock of $10,000. Among those interested are H. E. Teachout, president; J. W. Hill, vice-president and manager; H. C. Hansen, treasurer, and M. McFarland, secretary.

THE MADISON FARMERS' MUTUAL TELEPHONE COMPANY has been incorporated at Madison, Wis., with a capital stock of $10,000. The promoters of the company are M. C. Rathburn, George Kellogg, Frank Beebe, Lee Colby, Cassius Rand, Will Wheeler and D. B. McMackin.

THE NEW LONG DISTANCE TELEPHONE COMPANY has been incorporated at Indianapolis, Ind., with a capital stock of $1,000,000. The incorporators are S. P. Sheerin, A. H. Nordyke, D. M. Parry and Harry B. Gates, of Indianapolis; Alexander F. Ramsey, Crawfordsville; Daniel E. Dougherty, Louisville; George W. Beers, Fort Wayne.

THE PEEKSKILL TRACTION COMPANY, White Plains, N. Y., has filed articles of incorporation, with a capital stock of $150,000. The purpose of the company is the operation of an electric street railway 12 miles in length in the village of Peekskill and the towns of Cortlandt and Yorktown. The directors are Dr. Charles Mason, James H. Haight, Frank Frye, Charles N. Wells, J. R. Decatur, Matthew Clune, James F. Martin, Hanford Smith and Jacob Larsch.

The Telegraph and Telephone.

HARVARD, ILL.—Mr. Ezra Smith has applied for permission to establish a local telephone exchange.

HAWARDEN, IA.—The Iowa & Dakota telephone line is to be extended from Beresford to Alcester.

TORONTO, OHIO.—The Bell Telephone Company is extending its lines to all parts of Belmont County.

PRINCETON, ILL.—The Bureau County Telephone Company is considering the question of extending its lines.

LOUISVILLE, KY.—A movement is on foot to build a telephone line from East Fork to Louisa by way of Fallsburg.

QUEBEC, CANADA.—The Quebec City Council has decided to tax all telegraph and telephone poles 25 cents each.

CORYDON, IA.—Franchises for local telephone exchanges have been granted in Humeston and Allerton in this county.

HARBOR SPRINGS, MICH.—The Emmet County Telephone Company has made arrangements to extend its line to Sturgeon Bay.

ASHTABULA, OHIO.—The Ashtabula Telephone Company will construct a line to Red Brook this spring, and perhaps to Sturgeon Point.

PEKIN, ILL.—The Mason County Telephone Company has been granted a twenty-five-year franchise by the City Council to operate in this city.

HAMBURG, N. Y.—The Bell Telephone Company has been granted a franchise to operate in this village. The life of the franchise is fifty years.

TAYLORSVILLE, N. C.—There is some talk among the citizens of this place of building a telephone line between Taylorsville and Statesville.

MOULTRIE, GA.—J. F. Monk, W. H. Barber and others have received a franchise to establish a telephone system, and will organize a company for the purpose.

LANSING, MICH.—The Pingree bill for the taxation of telegraph, telephone, railroad and express companies has been killed in the Senate. The vote stood 15 to 16.

BOSTON, MASS.—A bill to give the gas and electric light commission supervisory powers over the telephone companies of this State was defeated in the House.

BOSTON, MASS.—The Erie Telegraph & Telephone Company added 620 subscribers to its system during March. The total number of subscribers on April 1 was 25,692.

TERRE HAUTE, IND.—A new telephone company is being organized in this city, and will make an effort to secure the franchise of the District Telegraph Company.

LITCHFIELD, KY.—Efforts are being made to raise a popular subscription to build a telephone line from East View to Elizabethtown and there connect with the Hardin County system.

HARPETH, TENN.—The Cumberland Telephone Company has extended its line from this place to Duplex, and, it is said, will in the near future extend the line south to Glenn's Store, Verona and other places.

OWOSSO, MICH.—The Owosso Telephone Company opened its office in this city on April 1, and is meeting with success. It has 150 subscribers. Connection is had with Detroit over the new State line.

SPARTA, WIS.—The Sparta Telephone Company has decided to make extensions of its lines to La Crosse and Norwalk, both connecting with all intermediate points. This company is an independent one.

GOLDEN, COL.—Mr. J. D. Babcock has received a franchise to build a telegraph and telephone line in the southeastern part of Jefferson County, connecting this city with Evergreen, a distance of 20 miles away.

BELVIDERE, ILL.—The Belvidere Telephone Company has made arrangements to connect with the McHenry County exchange. It will build lines to Garden Prairie, and there meet the lines of the McHenry Company.

ATWOOD, KAN.—The farmers of Rawlins County are considering the advisability of building a telephone line between Atwood and Achilles by way of Chardon, so that they may communicate more readily with the markets.

WABASH, IND.—The Central Union Telephone Company's exchange at

Fairmount has been closed because of insufficient patronage. The exchange at one time had fifty subscribers, but they dropped out until none were left.

STILLWELL, MINN.—Messrs. Otis Staples, James Mulvey and R. H. Bronson have applied for a telephone franchise in this place. These gentlemen are among the incorporators of a company organized to conduct the new business.

MADISON, S. DAK.—The Southern Telephone Company, of Madison, has been incorporated with a capital stock of $50,000. It will build a line from Pipestone to Madison. The line will probably be continued to Woonsocket and Mitchell.

AKRON, OHIO.—Four independent telephone companies have combined to fight the Central Union Company, which is seeking to renew its franchise in this city. The four companies desire to gain admission, and have pooled their interests.

GUTHRIE CENTRE, IA.—The citizens of this place have voted to give the Perry Telephone Company a twenty-year franchise. The Bell Company is asking for a similar franchise, and the matter will be submitted at a special election in the near future.

LA GRANGE, IND.—The Elkhart County Telephone Company has been purchased by a syndicate of Michigan and Ohio independent telephone companies. The consolidation will, it is stated, give a complete system from Toledo and Detroit to Chicago.

INDIANAPOLIS, IND.—The Commercial Club of this city has decided not to go into the telephone business. Steps were recently taken by some of the members to organize an independent company, but it seems that the notice was too short for definite action.

NOGALES, ARIZ.—The Temple Bar Consolidated Company will build a telegraph and telephone line from Kingman to Temple Bar, via White Hills, a distance of over 80 miles. Two wires will be strung and the line, it is said, will be one of the best in Arizona.

TIFFIN, OHIO.—The Home Telephone Company has now in operation about 350 instruments, and is connecting others as rapidly as the work can be done. The company has 100 more applications to fill, and expects to exceed the capacity of its 500-drop switchboard within a few weeks.

SEABRIGHT, N. J.—A telephone pay station has been established at Sandy Hook by the New York & New Jersey Telephone Company for the convenience of the military officers located at that point. The quarters of several of the officers at the Hook are also connected with the telephone system.

DAVENPORT, IA.—The Iowa Telephone Company will build new copper metallic circuits during the coming season over nearly 900 miles of territory, much of which will be entirely new work. The longest new line will be from Davenport to Des Moines, a distance of 222 miles. Twelve other lines are planned

OSHKOSH, WIS.—The Little Wolf River Telephone Company has closed a contract with the Oshkosh Northwestern Telephone Company, of this city, whereby the local exchange is to be connected with the toll system of the Wolf River Telephone Company, already in operation in parts of Winnebago and Waupaca counties.

BALTIMORE, MD.—The Standard Telephone Company, which owned the local telephone exchanges at Crisfield, Md., and Chestertown, Md., has removed its home office to Crisfield, Md., and elected officers as follows: Hon. James C. Tawes, president; E. Benson Dennis, vice-president; Edward P. Wyatt, treasurer; W. McG. Riggin, superintendent.

LITTLE ROCK, ARK.—The Southwestern Telegraph & Telephone Company opened its line from Little Rock to Fort Smith on April 5. A public reception was given to inaugurate the event. Little Rock now has connection with fifty-five towns in Arkansas and the Indian Territory. The company has 750 miles of long-distance lines and 2500 instruments under rental in the State.

MARSHALLTOWN, IA.—At the recent meeting of the directors of the Marshall Telephone Company the report was made that everything was in readiness to commence the building of the lines between Marshalltown and Boone, which will connect with about 300 Iowa towns. The company now operates over 450 instruments, and its list of subscribers is steadily increasing. It has recently ordered a new switchboard.

WASHINGTON, PA.—The West Penn Telephone Company has completed arrangements to build telephone lines between Washington, Cannonsburg, McDonald, Burgettstown and other points along the Pan Handle Railroad. covering the western and northwestern portion of Washington County. A metallic circuit will be built, and the rates will probably be $15 per year for private telephones, and $24 for business houses.

DAVENPORT, IA.—The Iowa Telephone Company has brought back to this city the general manager and superintendent, whose headquarters have been during the past year in Des Moines. These officials were sent to Des Moines because it was believed that they should be located near the centre of the State, but it has since developed that it would be more convenient to have them at the headquarters of the company, consequently they were brought back to this city.

MANITO, ILL.—The Mason County Telephone Company has been granted a franchise to build and operate a telephone line in this place. The new line will give direct communication with every point in the county, as well as those of adjacent counties. Long-distance instruments and metallic circuits will be used. The rates for business houses and residences will probably be fixed at $24 and $18, respectively. At Havana, the Mason County Telephone Company connects with the Fulton County Telephone Company, which reaches almost 100 towns.

ELECTRIC LIGHT AND POWER.

BROOKLYN, N. Y.—The official name of the Flushing Electric Light & Power Company has been changed to the New York & Queens Light & Power Company.

NEWARK, N. J.—The Newark Electric Light & Power Company has notified its employees to the effect that the positions of all those who belong to the National Guard and are called into service will be kept open until they return home. About two dozen employees belong to the militia.

PITTSBURG, PA.—The Beaver Falls electric light works have been sold to the Beaver Valley Electric Light & Power Company. The same company has purchased the works of the Rochester Electric Light Company. They are building an extensive plant at Fallston, and will furnish electric light and power to all the towns in the Beaver Valley.

THE ELECTRIC RAILWAY.

GOSHEN, IND.—Bristol will vote on the proposition to bond the town for electric lights and water.

ROCHESTER, N. Y.—The Geneva Common Council has voted in favor of a municipal electric lighting plant.

LEWISTON, ME.—The Board of Trade has unanimously voted in favor of extending the electric road to Turner.

MANCHESTER, N. H.—The office of the Exeter Street Railway Company has been transferred from Boston to Exeter.

FARMINGTON, ILL.—The voters of the village of Fairview will decide for or against electric lights at their corporation election this spring.

SYRACUSE, N. Y.—The contract for lighting the streets of Homer for five years has been awarded to the Cortland & Homer Traction Company.

WORCESTER, MASS.—The directors of the Webster & Dudley Electric Railway have held a special meeting and voted to build the line at once.

ALBANY, N. Y.—The Watervliet Common Council has authorized the mayor to issue bonds for $12,000 for making improvements to the electric light plant.

SAULT STE. MARIE, MICH.—The Edison Sault Electric Company will issue $75,000 6 per cent. coupon bonds on account of contemplated improvements.

ALBANY, N. Y.—J. M. Jones' Sons have shipped twenty-five cars of an order of forty to the Omaha Street Railway Company. Many other orders are on hand.

DETROIT, MICH.—The Village Board of Decatur has appointed a committee to determine the cost of an electric light plant. A special election will be called.

BOSTON, MASS.—Articles of association for the formation of a street railway corporation to operate an electric road between Whitman and Plymouth have been drawn up.

WASHINGTON, D. C.—It is reported that the Southern Railroad contemplates putting up wires and running trolley cars over its road between Washington and Herndon, Va.

SPRINGFIELD, MASS.—The directors of the street railway company have voted to petition the railroad commissioners for permission to increase the capital stock by $300,000.

UTICA, N. Y.—Surveyors are now surveying the projected route of the Utica and Frankfort trolley line. By the terms of the franchise the road must be completed by the end of the year.

NEW YORK CITY.—The incorporators of the Putnam & Thompson (Conn.) Electric Railroad have disposed of their charter to a syndicate of capitalists, who will build the road this summer.

TOLEDO, OHIO.—At the special election at Wapakoneta, the proposition to issue $5000 worth of bonds to improve and enlarge the electric light plant was carried by an overwhelming majority.

BALTIMORE, MD.—The Governor is not likely to sign the bill incorporating the Maryland Electric Railway Company. The Governor and the attorney-general are agreed that its provisions are too broad.

AMBLER, PA.—There will be no trolley between Ambler and Norristown, at least not for some time. Property holders refused the right of way into Ambler, and the advocates decided to abandon the project.

CHICAGO, ILL.—The City Council has given the Chicago, Milwaukee & St. Paul Railway Company a twenty-year franchise to use electric power on its Chicago & Evanston branch. This line is 20 miles in length.

PITTSBURG, PA.—The employees of the Consolidated Traction Company, who some time ago made a demand for an advance in wages and shorter hours, have been notified that there will be no change made in either.

PEORIA, ILL.—A. G. Danforth & Sons, of this city, at the head of a Peoria syndicate, have secured control of the Decatur light plant. The price paid is approximately $130,000. A new company is to be organized.

CINCINNATI, OHIO.—The Cincinnati Consolidated Street Railway has purchased the Mount Auburn Street Railway, and now owns the entire system of the city. The Mount Auburn line was sold under order of the court for $278,000.

ATLANTA, GA.—The Atlanta & Douglasville Electric Railroad Company has asked the General Council for the right to construct its lines in the city of Atlanta, and the company proposes to begin work as soon as it receives authority.

NEW HAVEN, CONN.—The Consolidated road has under consideration a plan to equip the railroad between New Haven and Derby with electricity.

The road is 10 miles long, and connects Ansonia, Derby and Shelton with New Haven.

BALTIMORE, MD.—The Legislature incorporated the Maryland Electric Railway Company. The capital stock is $10,000, with the privilege to increase it to $800,000. It proposes to build lines in Baltimore city and county and Harford County.

WESTERLY, R. I.—At its annual town meeting recently held, the town of Barrington appointed a committee to further in every way possible the building of an electric railroad to connect the shore towns from Bristol up with Providence.

WALTHAM, MASS.—The Newton Street Railway Company has declined to accept the franchise offered by the Board of Aldermen owing to its "unreasonable exactions," complaining that the burdens were such that no company could assume them and live.

STAMFORD, CONN.—It is stated that the Stamford & New Canaan branch of the New York, New Haven & Hartford Railroad will be equipped with the overhead trolley system by June 1. Some of the material required for the change has already arrived.

HARTFORD, CONN.—The Southington Burgesses have informed the Southington & Plantsville Tramway Company, which recently shut down its line, that it must either resume its service within thirty days or remove its rails, ties and trolley wires from the street.

BUFFALO, N. Y.—Messrs. Crage & Tench, of this city, have secured the contract for building the Lima & Honeoye Falls Electric Railroad. The contract also includes the wiring of the streets of both villages for electric lights, and the construction of the power house.

BOSTON, MASS.—The railroad commissioners have approved the issue of $50,000 worth of additional capital stock by the Globe Electric Street Railway of Fall River, the proceeds to be used in acquiring the franchise and property of the Fall River Electric Street Railway.

BRIDGEPORT, CONN.—The Consolidated Road has come into full possession of the power house of the Stamford Street Railroad, and will hereafter furnish power to the trolley line, instead of the local company furnishing the larger corporation with lights for the depot, etc.

CHICAGO, ILL.—The ordinance passed by the Council giving the Chicago, Milwaukee & St. Paul Railway Company the right to introduce electric power on its Evanston branch, has been vetoed by Mayor Harrison. The mayor thinks that the compensation to the city is too small.

HARRISBURG, PA.—The Carnegie & Washington Street Railway Company, of Allegheny, filed papers at the State Department April 15. It is the intention of the company to lay its tracks a distance of 2¼ miles, in the borough of Carnegie, Allegheny County. The capital stock is $18,000.

PITTSBURG, PA.—The committee on public works at Allegheny has received three bids for furnishing a dynamo for the electric light plant as follows: The Western Electric Company, $1960; the Fort Wayne Electric Corporation, $2000, and the General Electric Company, $2038.

EASTON, PA.—According to the annual report of the superintendent of the department of water and light, the cost per arc light during the year was $78.65, the lowest figures yet attained here for an all-night service. The superintendent recommends the replacing of the low-tension dynamos with high-tension dynamos.

BUFFALO, N. Y.—Considerable interest is manifested in the trolley line that is designed to connect Tonawanda with Lockport and Olcott, on Lake Ontario. Surveys are now being made. It will open up for Buffalo a territory that is thickly settled and studded with large and rapidly growing manufacturing establishments.

GREENSBURG, PA.—The trolley line from Broadford to Mount Pleasant via Scottdale is progressing. Right of way has been secured on both sides of Scottdale, and the Borough Council of that place will grant the desired franchise at the next meeting. Enough stock has been subscribed for to ensure the completion of the road.

ROCHESTER, N. Y.—The stockholders of the Rochester Street Railroad Company and of the Rochester & Irondequoit Electric Railroad Company will meet May 10, for the purpose of deciding the advisability of combining the two organizations into one system. The arrangement will probably be put in the form of a lease, in which the Rochester Railroad Company will be the lessee.

FALL RIVER, MASS.—The Globe Street Railroad directors have met and taken formal action looking to a consolidation with the Fall River Railroad. The latter's stockholders will soon meet for the same purpose. There are many legal formalities to be observed before the merging of the two concerns. It is expected that by a month both companies will be operated under one management.

Personal Notes.

MR. JAMES CUMMINGS, known in the electrical trade as the "Armorite King," is spending a few weeks holiday at his Detroit home.

PROF. R. B. OWEN, of the University of Nebraska, has been appointed to fill the John Tyndall fellowship of Columbia University. This fellowship was established for the encouragement of research in physics.

MR. W. F. BOSSERT, of the Bossert Electric Construction Company, Utica, N. Y., celebrated his fiftieth birthday on April 16. The employees of the company presented Mr. Bossert with a smoking chair, and in the evening that gentleman tendered a banquet to his employees.

MR. W. F. OSBORNE, for many years Eastern manager in this city of the "Western Electrician," has resigned that position to become business manager of the "National Provisioner." Mr. Osborne is one of the best-known men in the electrical journalistic field, and carries with him cordial good wishes for his continued success in his new sphere of newspaper work.

Trade Publications.

THE LIGHT FITTINGS made by A. P. Lundberg, Bradbury Electrical Works, Kingsland, London, N., England, are described and illustrated in a neat catalogue, a copy of which has reached The Electrical World. The various switches illustrated show differences in design compared with American switches.

MESSRS. PLUMMER, HAM & RICHARDSON, 619 Main Street, Worcester, Mass., have issued a catalogue of telephones, manufactured and installed by the firm. Various styles of instruments are illustrated, and there are some very neat designs among them. This firm deals in general electrical supplies, making interior telephone systems a specialty.

"BIDDLE'S BULLETIN" is the title of a monthly record published by Mr. James G. Biddle, Philadelphia, Pa., in the interest of those who use scientific instruments. The first number, which is dated April, briefly describes the various apparatus handled by Mr. Biddle, besides giving other information bearing upon the general subject. The first number contains eight pages.

THE LUNKENHEIMER COMPANY'S catalogue of valves, injectors, whistles, lubricators, oil and grease cups and steam specialties, just issued, contains 208 pages and is very complete and well arranged. Each page is complete in itself, and each device illustrated is accompanied by a concise description and table of dimensions and price list. The Lunkenheimer Company's headquarters are in Cincinnati, Ohio.

THE STEPHENSON MANUFACTURING COMPANY, 467 Broadway Albany, N. Y., manufactures belt dressing, boiler compound and other specialties. It has just issued a little pamphlet giving a list of users of its belt dressing and boiler compounds, and many testimonial letters concerning the same. The pamphlet is of interest to all who are engaged in generating and transmitting steam and electrical power.

MESSRS. PITT & SCOTT, 39 Broadway, New York, have issued a prospectus of their forthcoming publication entitled "Foreign Import Duties and Foreign Shippers' Handbook of Useful Information." This work will give the rates of import duties levied by the different European Governments on all classes of produce and manufactures, and will contain also other information of value to foreign shippers and to all those having business connections abroad.

MESSRS. P. M. MOWREY & CO., electrical engineers and contractors, 318 Broadway, New York, have issued a pamphlet in which is described the complete electric lighting equipment of the Bowling Green office building, 5-11 Broadway. This description is reprinted from The Electrical World of July 17, 1897. Messrs. Mowrey & Co. have attained prominence in this field, and are said to be the pioneers in unlined tube and vertical system construction. At the back of the pamphlet is published a long list of recent work installed by the firm.

THE GLOBE CARBON COMPANY, Ravenna, Ohio, in a neat little pamphlet describes and illustrates its various products, which consist of electric light carbons, plain, coppered and elliptical; carbon battery plates, carbon brushes, back plates and diaphragms for telephone transmitters; filament blocks on which incandescent lamp filaments are shaped and baked, and carbon battery cylinders. There are also described and illustrated the various forms of wet and dry battery cells and parts, manufactured by the Globe Company. The company also deals in battery chemicals.

THE WALKER COMPANY announces in its Circular No. 1072, on the subject of "Static Transformers," that it has investigated all the transformers for power transmission and lighting on the market with a view to furnishing in its alternating plants the very best auxiliary apparatus possible. As a result of these investigations the transformers made by the Wagner Electric Manufacturing Company, St. Louis, Mo., have been given the precedence over all others. The circular describes and illustrates the various types of the Wagner transformer. In another circular, No. 1073, the Walker Company gives some facts regarding its street railway motors. Attention is called to the most prominent features of these motors. These include the method of suspension, protection against foreign substances, accessibility, operation, speed and efficiency, simplicity, ease of repair, power, etc.

THE BURTON ELECTRIC SMELTING COMPANY, 144 Lincoln Street, Boston, Mass., manufacturer of electric metal and electrical ore working machinery, amalgamators, grinders, pulverizers, etc., has issued a thirty-two-page catalogue of its products. In it are illustrated direct-current liquid forges, and samples of work done with these forges, electric liquid soldering iron heaters, dry process metal heating apparatus and many other devices used in the various branches of the art. The process of electric liquid metal heating, and the construction of the apparatus are described, as are also the Burton electrical amalgamators. This company owns eighty-six United States letters patent relating to the smelting of ores, heating and working of metals by electricity. Its business is of great interest to central stations for the reason that the extending use of electric forging creates a demand for current. This application of electricity opens up a broad field of industrial work. By the use of the electric forge all the annoyances incident to use of the old method, such as smoke, dust and ashes, are entirely done away with. The electric carriage and blacksmith forges are designed for 220, 250 or 500 volts, and occupy floor space of 40 x 26 inches. The electric process is an economical one.

Trade and Industrial Notes.

THE BOARD OF PUBLIC WORKS of Grand Rapids, Mich., has extended the time for receiving bids on the electric lighting plant until May 5, at 2 P. M.

MR. WILLIAM E. QUIMBY, 120 Liberty Street, New York, manufacturer of screw pumps, will, about May 1, move into new quarters in the Washington Life Building, 86 Liberty Street.

THE SPRAGUE ELECTRIC COMPANY, New York, has just received an additional contract for the equipment of the Library of Congress in Washington with Lundell exhaust fan outfits. All of the outfits will be operated by Lundell power motors.

THE ILLINOIS ELECTRIC COMPANY, Chicago, announces that it has secured the Chicago agency for the 1898 model Lundell fan motor, made by the Sprague Electric Company, New York. It will carry in Chicago a full stock of these machines.

THE PARTRIDGE CARBON COMPANY, Sandusky, Ohio, has recently put on the market a new all-plumbago generator brush, which is especially adapted for machines that carry a heavy current. These brushes are very high in conductivity and low in resistance.

FOOTE, PIERSON & CO., 82 Fulton Street, New York, on account of their increasing business have been obliged to secure larger quarters. They have moved from the fifth floor of the building they are in to the third floor, where they have three times the floor space.

THE WESTERN ELECTRIC COMPANY, Chicago, announces that it has the exclusive agency for the Sprague Electric Company's conduit, and has in stock in Chicago a large and complete supply of interior conduit of all sizes upon which it is prepared to quote the lowest figures.

THE AMERICAN ELECTRIC HEATING CORPORATION, Boston, Mass., states that its Universal enamel rheostats are extending in favor and giving excellent satisfaction. Among the prominent plants in this vicinity in which these rheostats have been installed is that of the New York Federal Building, which was described in THE ELECTRICAL WORLD of March 26.

CONSIDERABLE INTEREST is attached to the exhibit of the electric elevator machine for the London Underground Railway, which is to be shown at the Electrical Exposition to be held in Madison Square Garden, New York, commencing May 2. The London machines of this type are the largest elevator machines ever built, and were built by the Sprague Electric Company, New York.

THE AMERICAN ELECTRIC FUSE COMPANY, 521-531 Wabash Avenue, Chicago, has enlarged its works. The new works are equipped with improved machinery, which enables the company to manufacture its goods with much greater rapidity. The company is now in a position to turn out fuses and links of any size, shape or form for telegraph, telephone, electric light and power circuits.

THE GREAT NORTHERN HOTEL, Chicago, will, in the near future, install an electrical plant which will include three 225-hp Ball cross-compound engines, built by the Ball Engine Company, Erie, Pa., each direct-connected to a 150-kw Western Electric generator. The Ball Engine Company is building an engine to go to Mexico, and is supplying the engines to be installed in the electric plant in the Rowe Building, East End, Pittsburg, Pa.

THE JOHN STEPHENSON COMPANY, LIMITED, has just awarded the Sprague Electric Company, New York, another large contract for Lundell power motors, with which to equip its blacksmith and machine shops. The John Stephenson Company, as is well known, is erecting a new car building plant at Elizabethport, N. J., and for this plant the Sprague Electric Company has secured contracts for Lundell motors for the mill, shops, cabinet shop, and blacksmith and machine shops.

MESSRS. THOMAS G. OAKES & CO., 54 John Street, New York, have ready for distribution their catalogue and price list for 1898 and 1899. It gives sizes and prices of the "Oakes Acorn" globe, angle, cross, check, off-set corner and radiator valves from an eighth inch upward, and also the prices on Oakes discs for high and low pressure, and "Oakes Acorn Jointing" and "Royal Red Packing." This catalogue is in handy shape for ready reference. and will be sent, post-paid, to anyone interested upon application.

THE UTICA ELECTRICAL MANUFACTURING & SUPPLY COMPANY, Utica, N. Y., of which Mr. W. C. Ballda is general manager, is not only busy in its engineering and contracting departments, but is receiving orders from all parts of the Union for repair work upon armatures, generators, dynamos and electrical apparatus in general. The fact is that it has secured the services of Mr. H. C. Abbe, who has charge of the repair department, and who, with some eleven years' practical experience in this particular line of the electrical industry, should prove a sufficient "earnest" as to its ability to repair any and all work entrusted to it.

MESSRS. J. B. COLT & CO., manufacturers of the well known Criterion arc lamp used in connection with the Criterion projection lantern, have removed their offices to large and commodious quarters at 3, 5 and 7 West Twenty-ninth Street, New York, where they will have one of the handsomest and most extensive show rooms of the kind in New York. This old-established firm manufactures apparatus for the manipulation of light, reflectors, prisms. lenses, etc., and furnishes the new well-known animated pictures which have become so justly popular.

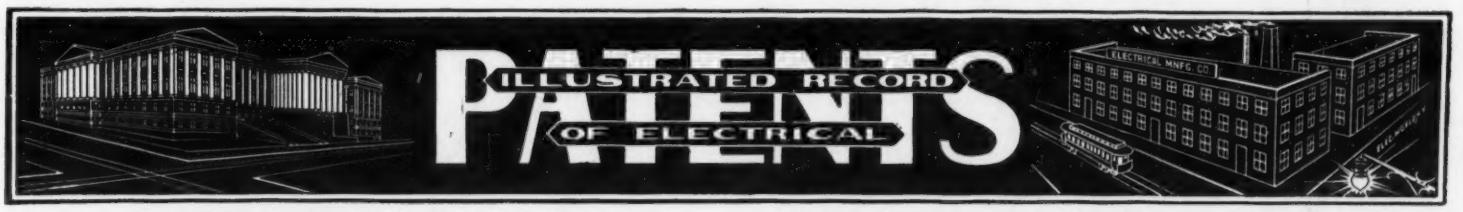
THE UNITED STATES PROJECTILE COMPANY, Brooklyn, N. Y., has in the past week placed orders with the American Tool Works Company, Cincinnati, Ohio, for a number of 22-inch and 24-inch engine lathes. The American Tool Works Company has also received through its office at Vienna, Austria, an order from the Oesterreichische Schuckert-Werke at Vienna for a number of boring mills, lathes and planers. It has also received through its office at St. Petersburg, Russia, an order for a number of large lathes and planers from W. Pravlanica Obschchestwah Istee-inskich Metallourgeetcheskichee Mechaneecheskich Sahvodoff, one of the largest iron works in Russia.

AN INTERESTING TEST of a Wirt rheostat was recently made by Messrs. Queen & Co., Incorporated, Philadelphia. The rheostat was tested at five times its rated capacity in watts, with full resistance in circuit, and the load thrown suddenly on the cold rheostat. The result of the test shows the temperature, taken with a thermometer with the bulb in outside contact merely, to have been 370 degrees at the end of thirty minutes and 400 degrees at the end of sixty minutes, starting at 70 degrees Fahr. The watts on the rheostat at the start were 1030, at the end of thirty minutes 1190 and at sixty minutes 1230. The overload at these periods of time was 5.77, 6.30 and 6.50. The insulation, after the test, while hot, measured 1.6 megohms. After cooling to 212 degrees it measured 5.4 megohms, and when cold 64.5 megohms. The case of the rheostat was hot enough to scorch paper and melt solder.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

THE AMERICAN NAVY, CUBA AND HAWAII.—A portfolio, in ten parts, sixteen views in each part, of the finest half-tone pictures of the American Navy, Cuba and Hawaii has just been published, and the Chicago, Milwaukee & St. Paul Railway has made arrangements for a special edition for the benefit of its patrons, and will furnish the full set, 160 pictures, for $1. In view of the present excitement regarding Cuba these pictures are very timely. Send amount with full address to George H. Heafford, General Passenger Agent, C. M. & St. P. Ry., Chicago, Ill.



UNITED STATES PATENTS ISSUED APRIL 19, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

602,422. APPARATUS FOR LOCATING OBSTRUCTIONS IN TUBES; B. C. Batcheller, Philadelphia, Pa. App. filed Sept. 28, 1897. A method of locating obstructions in tubes which consists in connecting the tube to be tested with an apparatus for recording time intervals and sound waves created in the tube, making a loud noise, as by an explosion, in the part of the tube to which the recording apparatus is attached, partly closing the connection from the tube to the recording apparatus prior to the making of said loud noise therein so as to avoid an undue strain on the recording apparatus, and immediately opening said connection after the sound impulse is created in the tube, so as to afford a free passage to the recording apparatus for the sound impulse reflected from the obstruction in the tube.

602,423. RAILWAY SIGNALING APPARATUS; H. Bezer, New Rochelle N. Y. App. filed Aug. 22, 1893. A signal for railways, comprising a semaphore blade of opaque material adapted to make a series of continuous revolutions in a substantially vertical plane, and adapted to assume a defined predetermined position, a lantern located behind the said semaphore blade, means for continuously revolving the semaphore blade, thereby flashing the light to indicate one condition of the track, and means for causing the semaphore blade to automatically assume a defined predetermined position to indicate a different condition of the track.

602,429. VALVE CONTROLLER; A. E. Colgate, New York, N. Y. App. filed Sept. 19, 1896. The combination with a main valve designed to be held to its seat by the pressure from the inlet, of a valve stem provided with an actuating piston working in a separate chamber and adapted to be actuated by the pressure from the inlet to open the main valve, and piston on said valve stem working in a chamber to cushion the opening stroke of the main valve, a passage from the inlet to the chamber of the actuating piston, and an auxiliary valve for controlling said passage.

602,434. SIGNALING DEVICE FOR RAILWAY CARS; F. W. Diehl, Detroit, Mich. App. filed Sept. 28, 1897. A circuit closing device, comprising a casing adapted to be secured to the car above the heads of the passengers and provided with openings in the top and front, an insulated pivoted contact lever having one end projected through the front opening, an insulated contact plate secured inside the casing in the path of the movement of the lever, an insulated spring for normally holding the lever and plate apart, the circuit wires entering the casing through the top opening and connected respectively to the lever and contact plate, and a cord attached to the projecting end of the lever and depending in reach of the passengers.

602,463. TROLLEY WIRE HANGER; W. A. McCallum, Cincinnati, Ohio. App. filed Aug. 16, 1897. In a line hanger, the combination of a holder; a screw cap having its inner face provided with teeth or corrugations adapted to engage by backward rotation of the screw cap; an insulated bolt seated in the holder, and provided with teeth or corrugations corresponding with those of the cap; and an interposed compressible disc.

602,493. ELECTRIC CONTACT SHOE; W. M. Brown, Johnstown, Pa. App. filed Nov. 14, 1896. A continuous contact member in combination with a continuous elastic member secured thereto.

602,527. ELECTRICAL MEASURING INSTRUMENT; H. W. Sullivan, London, England. App. filed Nov. 6, 1896. An electrical instrument having in combination an oscillating coil, a core therefor and magnets in whose field the coil oscillates, having poles with pointed extremities brought into close juxtaposition with the portions of the core without interfering with the movement of the coil.

602,557. ALTERNATE CURRENT METER; C. P. Feldmann, Cologne, Germany. App. filed Dec. 21, 1897. In alternate current meters having no direct supply of current to the movable armature, the combination of a thin layer of magnetic material with the armature of the brake body connected to the same for the purpose of creating a differential effect of such dimensions that a fixed zero position is produced, the sensitiveness of the meter remaining practically unaltered.

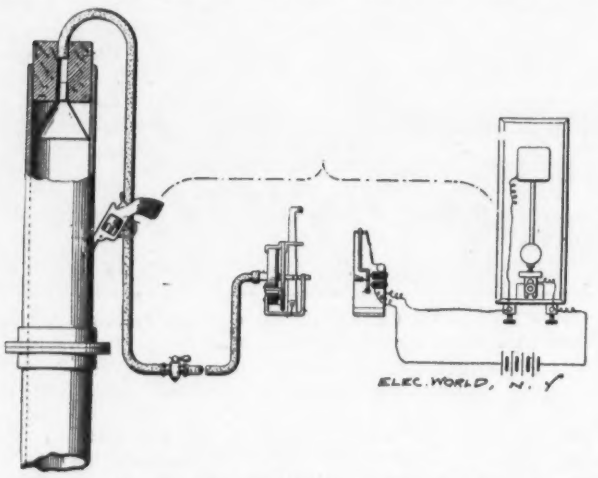
602,564. INSULATED PIPE COUPLING; G. Peeples, Philadelphia, Pa. App. filed June 19, 1896. In combination, a gas pipe or supporting tube, a joint for the support of the electrolier, a cap or block for said pipe within said joint, insulating material between the sides of the cap or block and the joint, and between the top of the cap or block and the upper portion of the joint, and a tube of insulating material surrounding the gas pipe from the joint to the point where the pipe emerges from the ceiling or wall.

602,576. BRACKET FOR INSULATORS. ETC.; J. R. Fletcher, Dayton, Ohio. App. filed Jan. 4, 1896. An insulator bracket provided with a head for the insulator or insulator plug, and a blade having one flat side and two recessed sides and tapering from butt to point, adapted to be driven into a supporting surface to secure same without the use of screws or plugging.

602,584. ELECTRIC RAILWAY; H. W. Libbey, Boston, Mass. App. filed Dec. 10, 1894. The combination with a closed conduit, of two rows of parallel alternately arranged metallic bars, insulatingly embedded in the top, and extending from the upper to the lower surface thereof, a supply wire within the conduit, movable conductors between the wire and the bars, and a magnetic trolley, the free end of which is provided with two contact points, side by side, and adapted to be engaged with the alternately arranged bars.

602,596. ELECTRICAL APPARATUS; H. H. Eldred, Brooklyn, N. Y. App. filed April 4, 1896. In combination a magneto instrument made up of a magnet and an armature mounted on a shaft, a vibrating arm; means to connect and disconnect that arm with the shaft of the armature of the magneto instrument; mechanism to revolve the armature shaft; and means to connect and disconnect that mechanism with the armature shaft, whereby the magneto instrument may be caused to vibrate the arm, when the arm is connected and the revolving mechanism disconnected, and may be used as a generator when the arm is disconnected and the revolving mechanism connected.

602,616. INVERTIBLE FLUID BATTERY; P. R. Cunningham and C. H. Howland-Sherman, Washington, D. C. App. filed Feb. 20, 1897. The combination of a closed casing, electrodes, of less height than the interior of the casing, removably inserted therein and designed to be freed from the electrolyte, when the casing is inverted, and retaining means engaging with the tops of the said electrodes, but insulated therefrom, and interlocking interiorly with the casing to secure said electrodes in a fixed position and against displacement when the casing is inverted.

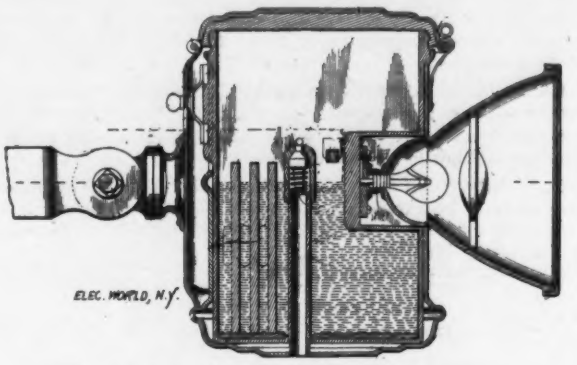


No. 602,422.—Apparatus for Locating Obstructions in Tubes.

602,678. TRAVELING CONTACT FOR UNDERGROUND ELECTRIC RAILWAYS; G. B. Coleman and J. W. Duggan, Washington, D. C. App. filed Nov. 2, 1897. The combination with a traveling contact or current collector for underground electric railway systems, of two pairs of lead wires provided with independent couplings, and independently connected to the contact shoes of the device.

602,709. APPARATUS FOR REDUCING ELECTRIC CURRENTS AND VOLTAGE; A. F. Vetter, Long Island City, N. Y. The combination with the supply circuit, of resistance controlling the current strength, a second resistance placed in the supply circuit, a shunt circuit including translating devices, and means for transferring a portion of the second resistance of the supply circuit to the shunt circuit.

602,746. STREET INDICATOR; E. J. Hall, St. Louis, Mo. App. filed Nov. 3, 1897. A street indicator, comprising a dial, a hand adapted to travel over the dial, a spring gearing, a battery, a magnet connected with one pole of the battery, a spring arm carrying an armature over the magnet, a notched disc controlled by the arm and operated by the gearing, a trolley wire provided with a spur, a trolley rod, a plate mounted on the trolley rod, a contact place and spring pawl mounted on the rod plate, and connected with the other pole of the battery and with the magnet.

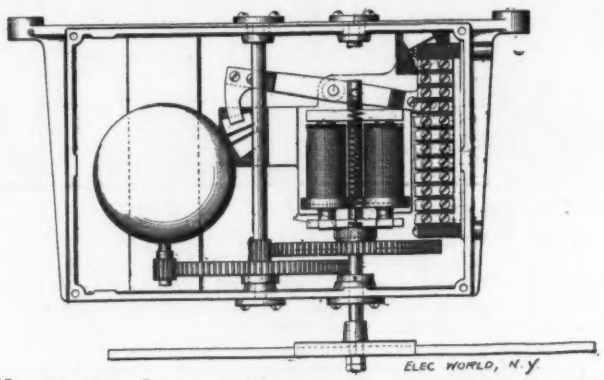


No. 602,616.—Invertible Fluid Battery.

602,767. ELECTRIC SWITCH; A. G. McPherson, Highland Park, Ill. App. filed May 1, 1897. A device having in combination two isolated contacts each adapted to be connected with one limb of an electric system, a longitudinally shiftable contact piece adapted to connect alternately with said contacts, and being in electrical communication with another limb of said system, an oscillatory lever or handle pivoted at a point between said contacts, an elastic connection between said lever or handle and said shiftable piece, and means for retarding the movement of said shiftable piece while in electrical communication with either of said contacts.

602,774. ELECTRIC MUSCULAR EXERCISER; E. Sandow, London, England. App. filed Jan. 24, 1898. The combination, with an elastic cord exerciser, of handles attached to the cords of the exerciser, wires attached to the handles and extending the length of the cords, being so united with the cords as to be capable of extending with them so as not to interfere with the elasticity thereof.

602,781. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; A. J. Stopher, London, England. App. filed Feb. 16, 1898. The combination of a rotatable cylinder provided with contact segments arranged circumferentially thereon, spring contacts mounted on a fixed support and arranged to be periodically engaged by the contact segments on the rotatable cylinder, means for rotating the cylinder, and a switch comprising two independent series of oppositely arranged fixed spring contacts, a pivoted switch arm and a cam geared to revolve with the cylinder and operating to oscillate said switch arm to alternately contact with said series of spring contacts.



No. 602,792.—Railway Signaling System and Apparatus.

602,792. RAILWAY SIGNALING SYSTEM AND APPARATUS; Hy. Bezer, New Rochelle, N. Y. App. filed Dec. 3, 1895. A signal for railways, comprising a post or support, an arm extending therefrom, a substantially straight semaphore blade broader than the arm and fitted to rotate in a plane substantially vertical, and substantially at right angles to the direction of traffic, and pivoted to the arm at such a distance from said post or support as to be substantially clear of the background of said post or support in all positions of a full revolution, and means for rotating said semaphore blade, and for stopping and holding at rest said semaphore blade in one or more predetermined positions.